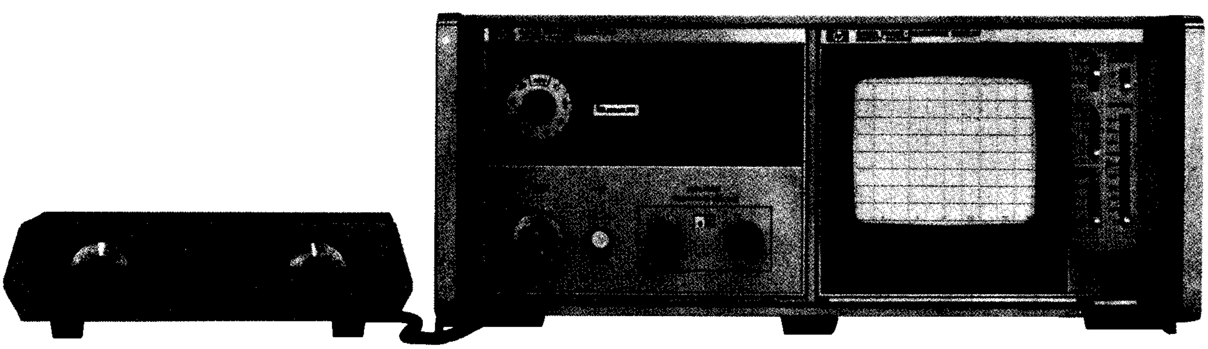
OPERATING AND SERVICE MANUAL

8410B NETWORK ANALYZER

8411A HARMONIC FREQUENCY CONVERTER

Includes Opt. 018



HEWLETT PACKARD

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OPERATING AND SERVICE MANUAL

8410B NETWORK ANALYZER

SERIAL NUMBERS

This manual applies directly to HP Model 8410B Network Analyzers having serial number prefix 1902A and 1941A. With changes described in Section VII, this manual also applies to 8410B Network Analyzers with serial number prefixes between 1450A and 1741A.

8411A HARMONIC FREQUENCY CONVERTER

SERIAL NUMBERS

Includes Option 018

This manual applies directly to HP Model 8411A Harmonic Frequency Converters having serial number prefix 1925A. With changes described in Section VII, this manual also applies to 8411A Harmonic Frequency Converters with serial number prefixes between 803 and 1905A.

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CONTENTS

CONTENTS (Cont'd)

ILLUSTRATIONS

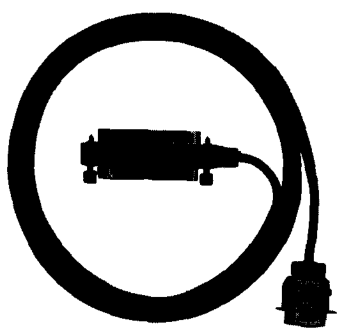
ILLUSTRATIONS (Cont'd)

TABLES

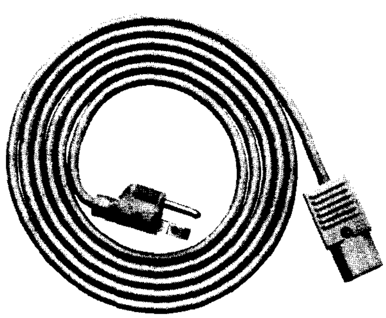


8411A

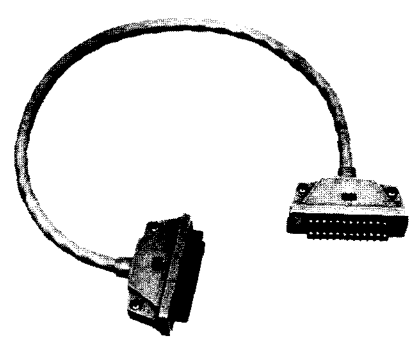
8410B



SOURCE CONTROL
CABLE
(HP Part No. 8120-2208)
(For 8620C Sweep Oscillator)



POWER CABLE
(See Table 2-1 for HP Part Number)



SERVICE CABLE
(HP Part No. 8410-60067)

Figure 1-1. Models 8410B, 8411A And Accessories Supplied

SECTION I
GENERAL INFORMATION

1-1. DESCRIPTION

1-2. The combination of Model 8410B Network Analyzer, Model 8411A Frequency Converter, and a display unit for the Model 8410B, functions as a phasemeter and a ratiometer for direct, continuous, simultaneous phase and magnitude ratio measurement of RF voltages. The complete network analyzer measures phase angles from 0 to 360° and magnitude ratios in decibels over a dynamic range of 60 dB. These measurements can be made on single frequencies and on swept frequencies in overlapping octave bands from 110 MHz to 12.4 GHz (110 MHz to 18 GHz for Option 018).

1-3. Measurements possible with the network analyzer include: direct determination of scattering (s) parameters; swept-frequency response measurements of phase sensitive systems; analysis of parameters relating to the use of solid state devices in wideband circuits; group delay measurements for communications systems; analysis of magnitude and phase distortion in filters, amplifiers, and preamplifiers; antenna testing; and performance testing of components in sophisticated radars. Although the network analyzer is intended primarily for wideband coaxial measurements, it can also be used with waveguides within the limits imposed by waveguide bandwidths and the characteristics of waveguide-to-coax adapters.

1-4. The Models 8410B and 8411A convert the two RF signals being measured to two 278 kHz signals that have the same magnitude and phase relationships. The display unit used with the Model 8410B converts these 278 kHz signals to a CRT or meter display. External monitoring points for the 278 kHz signals are provided on the Model 8410B. Operating power for the display unit and for the Model 8411A is furnished by the Model 8410B.

1-5. The Model 8411A automatically tracks the frequency of the signal applied to the reference input. This automatic tuning and tracking takes place over a selected octave or, with an appropriate sweeper interface, a multioctave frequency band. In addition to the band selector, the search and hold range of the automatic tuning can be adjusted for best performance with the selected band. For a discussion of swept signal source requirements, see paragraph 1-68.

1-6. The signal applied to the reference input of the Model 8411A is used as the reference for both phase and amplitude measurements. Since it actuates the automatic tuning, its level is critical. A meter on the Model 8410B continuously monitors the reference channel signal level and indicates whether it is in the range required for making measurements.

1-7. Controls on the Model 8410B include phase and precision step-action amplitude offset controls. The vernier controls are for convenience in setting reference and calibration phase and amplitude indications. The amplitude offset controls allow large amplitude differences to be measured with greater resolution.

1-8. Complete specifications for the Model 8410B/8411A combination are given in Table 1-1. Specifications that include display unit performance are given in the Operating and Service Manuals for the display units.

1-9. INSTRUMENTS COVERED BY MANUAL

1-10. Each Model 8410B and Model 8411A carries a two-section serial number. The two sections are separated by either a hyphen or a letter. The numbers in the first section are a prefix. The contents of the manual apply directly to Models 8410B and 8411A that have the serial number prefixes listed on the title page.

1-11. Revisions required to adapt this manual to instruments with serial number prefixes not listed on the title page are given in a yellow Manual Changes insert supplied with the manual. For information concerning serial number prefixes not listed on the title page or in a Manual Changes insert, contact the nearest Hewlett-Packard office listed at the rear of this manual.

Table 1-1. Models 8410B and 8411A Specifications

Frequency Range:
8410B: 0.110 to 18 GHz.
8411A: 0.110 to 12.4 GHz.
Option 018: 0.110 to 18 GHz

RF Frequency Tracking:
Typically <35 ms/octave

8411A Input Impedance: 50 Ohms nominal.
SWR <1.5, 0.11 to 2 GHz; <2.0, 2 to 6 GHz; <3.0, 6 to 12.4 GHz; <3.0, 6 to 18 GHz (Option 018).

Channel Isolation: >65 dB, 0.11 to 6 GHz; >60 dB, 6 to 12.4 GHz; >50 dB, 12.4 to 18 GHz.

MAGNITUDE

Magnitude Range:
Reference Channel: Phase-lock is maintained (REF CHANNEL LEVEL meter in OPERATE range) for Reference Channel input levels between −18 dBm and −35 dBm from 0.11 to 12.4 GHz, and between −18 dBm and −25 dBm from 12.4 to 18.0 GHz (Option 018). Common amplitude variation at the reference and test channel inputs within these ranges result in <1.5 dB change in measured magnitude ratio and <4 degrees change in measured phase angle.

Test Channel: −10 to −75 dBm from 0.11 to 12.4 GHz; −10 to −68 dBm from 12.4 to 18 GHz.

Maximum RF input to either Channel: 50 mW (+17 dBm) damage level.

Maximum dc on RF line: ±3 V (damage level).

IF Gain Control: Adjusts gain of test channel relative to reference channel.
Range: 69 dB total in 10 dB and 1 dB steps; vernier provides continuous adjustment over at least 2 dB.
Accuracy: ±0.1 dB per 10 dB step, ±0.05 dB per 1 dB step. Maximum cumulative, ±0.2 dB.

Frequency Response: Reference and test channels typically track within:
±0.3 dB for any octave 0.11 to 4.0 GHz.
±0.5 dB for any octave 4.0 to 12.4 GHz.
±1.5 dB 12.4 to 18 GHz (Option 018)
Magnitude discontinuity resulting from harmonic number changes: Typically <0.25 dB.

Noise: Less than −75 dBm equivalent input noise 0.11 to 12.4 GHz; −68 dBm 12.4 to 18 GHz (Option 018).

PHASE

Phase Range: 0 to 360°.

Control: Vernier provides continuous phase reference adjustment over at least 90°.

Frequency Response: Reference and test channels typically track within:
±1° for any octave 0.11 to 4.0 GHz.
±3° for any octave 4.0 to 12.4 GHz.
±10° 12.4 to 18 GHz (Option 018).
Phase discontinuity resulting from harmonic number changes: Typically <2°.

GENERAL

Outputs: Two rear panel auxiliary outputs provide 278 kHz IF signals; outputs may be used for signal analysis, special applications, and convenient test points; modulation bandwidth nominally 10 kHz.

Reference Channel IF: 2 volts peak-to-peak.

Test Channel IF: 10 volts peak-to-peak or less, depending on signal level and test channel gain setting.

Connectors (8411A): APC-7®[2]

Cable Supplied: One Source Control Cable is supplied, HP Part No. 8120-2208, for use with the 8620C Sweep Oscillator. For servicing the plug-ins, a Service Cable is included, HP Part No. 08410-60067.

Power: 100, 120, 220, or 240V ac +5% -10%, 50 to 60 Hz, 70 watts (includes 8411A).

Weight:
8410B: Net, 14,9 kg (33 lb.). Shipping 18,5 kg (41 lb.).

8411A: Net, 3,2 kg (7 lb.). Shipping 4,5 kg (10 lb.).

Dimension:
8410B: 191 mm high, 425 mm wide, 467 mm deep (7-1/2 in. × 16-3/4 in. × 18-3/8 in.)

8411A: 67 mm high, 228 mm wide, 143 mm deep (2-5/8 in. × 9 in. × 5-5/8 in.), exclusive of connectors.
5 ft. cable permanently attached for connection to 8410B.

[1] Specifications for the 8411A 018 Option below 12.4 GHz are the same as the standard instrument. Specifications above 12.4 GHz apply to the Option 018 only.
[2] APC-7® is a registered trademark of the Bunker Ramo Corporation.

1-12. WARRANTY

1-13. Terms of the warranty on the 8410B and 8411A, and all supplied accessories are described in the warranty on the inside of the front cover. For any additional information concerning warranty, contact the nearest Hewlett-Packard field office listed at the rear of this manual.

1-14. SAFETY CONSIDERATIONS

1-15. General

1-16. The HP Models 8410B and 8411A are Safety Class I instruments and have been manufactured and tested to international safety standards.

1-17. Operating Precautions

CAUTION

BEFORE APPLYING POWER make sure the instrument's ac input is set for the available ac line voltage, that the correct fuse is installed, and that all normal safety precautions have been taken.

Maximum RF Power. Do not apply more than 50 milliwatts of RF power to the Model 8411A inputs. Power in excess of 50 milliwatts may damage the frequency converter units.

Maximum DC on RF line. Steady state (dc) voltage on the inner conductor of the transmission line carrying signals to the Model 8411A must not exceed ±3 volts. Greater dc voltage prevents normal operation of the Model 8411A, and may damage the converter units.

Static Discharge. Static electrical charge on cables being connected to the Model 8411A inputs can damage the converter units. Before a cable is connected to the Model 8411A, it should be discharged by momentarily touching its inner conductor to the outer parts of the Model 8411A input connecter. Another way to prevent static discharge is to first connect the input end of the cable to a discharge path such as that provided by the output termination of a signal source. There is no risk of static discharge when connections are made directly to Model 8740A, 8741A, 8742A, 8743A, 8745A, or 8746B Test Units because internal terminations provide discharge paths.

1-18. Safety Symbols

⚠ **Instruction manual symbol: the apparatus will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect the apparatus against damage.**

ϟ **Indicates dangerous voltages.**

⏚ **Earth terminal (sometimes used in manual to indicate circuit connected to grounded chassis).**

WARNING **The WARNING sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.**

CAUTION **The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the equipment. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.**

1-19. Service

The information, cautions, and warnings in this manual must be followed to ensure safe operation and to keep the instrument safe. SERVICE AND ADJUSTMENTS SHOULD BE PERFORMED ONLY BY QUALIFIED SERVICE PERSONNEL.

Adjustment or repair of the opened instrument with the ac power connected should be avoided as much as possible and, when unavoidable, should be performed only by a skilled person who knows the hazard involved.

Capacitors inside the instrument may still be charged even though the instrument has been disconnected from its source of supply.

Make sure only fuses of the required current rating and type (normal blow, time delay, etc.) are used for replacement. Fuse requirements are indicated on the instrument's rear panel. Do not use repaired fuses oı short-circuit fuse holders.

Whenever it is likely that the protection has been impaired, make the instrument inoperative and secure it against any unintended operation.

WARNING

If this instrument is to be energized through an auto-transformer (for voltage reduction), make sure the common terminal is connected to the earthed pole of the power source.

BEFORE SWITCHING ON THE INSTRUMENT, the protective earth terminal of the instrument must be connected to the protective conductor of the (mains) power cord. The mains plug shall only be inserted in a socket outlet provided with protective earth contact. The protection action must not be negated by using an extension cord (power cable) without a protective grounding conductor. Grounding one conductor of a two-conductor outlet is not sufficient protection.

Any interruption of the protective (grounding) conductor, inside or outside the instrument, or disconnection of the protective earth terminal is likely to make this instrument dangerous. Intentional interruption of the earth ground is prohibited. Whenever it is likely that the protection has been impaired, the instrument must be secured against any unintended operation.

Servicing this instrument often requires that you work with the instrument's protective covers removed and with ac power connected. Be very careful; the energy at many points in the instrument may, if contacted, cause personal injury.

1-20. ACCESSORIES FURNISHED

1-21. A detachable power cable, source control cable, and servicing cable are supplied with the Model 8410B. No accessories are furnished with the Model 8411A.

1-22. Source Control Cable for 8620C

1-23. A source control cable (HP Part No. 8120-2208) provides the control logic interconnection to the 8620C Sweep Oscillator necessary for automatic multi-octave operation.

1-24. Servicing Cable

1-25. The servicing cable (HP Part No. 8410-60067) permits all necessary interconnections to be made between the Model 8410B and a plug-in display unit with the unit outside the plug-in compartment.

1-26. ACCESSORIES AVAILABLE: (See also HP Coaxial and Waveguide Catalog)

1-27. Accessory Kit

1-28. A kit containing an assortment of the line sections, adapters, shorts, and attenuators, together with special APC-7 connector tools and replacement inner conductor contacts, is available from Hewlett-Packard as Accessory No. 11587A. (See Figure 1-2.) The kit consists of the items listed in Table 1-2 and is housed in a sturdy plastic container that has storage space for additional accessories.

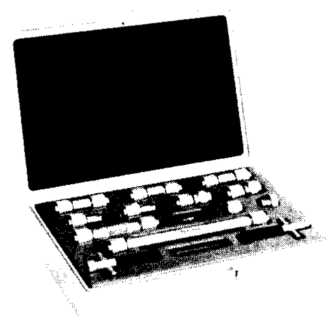


Figure 1-2. Accessory Kit No. 11587A

Table 1-2. Components of Accessory Kit No. 11587A

Quantity	Description	HP Part Number
1	10-cm Air Line	11566A
1	20-cm Air Line	11567A
2	APC-7 to N Female Adapter	11524A
2	APC-7 to N Male Adapter	11525A
2	10-dB Fixed Coaxial Attenuators	8492A Option 010
1	30-dB Fixed Coaxial Attenuator	8492A Option 030
1	N Female Coaxial Short	11511A
1	N Male Coaxial Short	11512A
1	Open End Wrench 9/16" x 1/2"*	8710-0877
1	Contact Extractor Tool*	5060-0236
1	Spanner Wrench*	5060-0237
5	Replacement APC-7 Inner Conductor Contacts	1250-0907

*APC-7 Connector Tools

1-29. Source Control Cable For 8620A

1-30. A source control interconnect cable (HP Part No. 08410-60115) is necessary for automatic multi-octave operation of the 8620A with the 8410B. This cable may be ordered through your nearest Hewlett-Packard office.

1-31. Rack Mounting Kit

1-32. A rack mounting kit is available to install the instrument in a 19-inch rack. Rack mounting kits may be obtained through your nearest Hewlett-Packard office by ordering HP Part Number 5060-8741.

1-33. APC-7 Connector Tool Kit

1-34. The APC-7 Connector Tool Kit No. 11591A contains all of the special tools needed to service APC-7 connectors. The kit is housed in a durable plastic container and consists of the items listed in Table 1-3.

Table 1-3. Components of APC-7 Connector Tool Kit No. 11591A

Quantity	Description	HP Part Number
1	Contact Extractor	5060-0236
1	Spanner Wrench	5060-0237
2	1/2" x 9/16" Open End Wrench	8710-0877
2	Pin Vise	8710-0932
5	Inner Conductor Contact	1250-0907

1-35. Adapters

1-36. Table 1-4 lists adapters available to accommodate some of the most common connector types.

Table 1-4. Adapters

Adapter	Manufacturer	Model Number
APC-7 to N female	1	11524A
APC-7 to N male	1	11525A
APC-7 to OSM male	1	11533A
APC-7 to OSM female	1	11534A
APC-7 to BNC	2	131-1027
APC-7 to TNC	2	131-1026
APC-7 to NPM	2	131-91035
APC-7 to GR874	3	0874-9791
GR874 to GR900	3	0874-9709

1. Hewlett-Packard
2. Amphenol RF Division, Danbury, Connecticut
3. Gen Rad, Concord, Massachusetts

1-37. Fixed Coaxial Attenuators

1-38. Fixed coaxial attenuators are useful for reducing mismatch ambiguities, reducing power to safe levels for power-sensitive devices, and improving signal-to-noise ratio for wide range attenuation measurements.

1-39. 8492A Series. These attenuators have APC-7 connectors, and can be used from dc to 18 GHz. Their nominal attenuation values and SWR are listed in Table 1-5.

1-40. 8491B Series. These attenuators have one male and one female type N connector, and can be used from dc to 18 GHz. Their nominal attenuation values are listed in Table 1-5.

Table 1-5. HP 8491B and 8492A Attenuators

Option Number	Atten-uation	Maximum SWR	
		8491B	8492A
003	3 dB	<1.2,	<1.15,
006	6 dB	dc to 8 GHz;	dc to 8 GHz;
010	10 dB	<1.3,	<1.25,
020	20 dB	8 to 12.4 GHz;	8 to 12.4 GHz
030	30 dB	<1.5,	<1.35,
040	40 dB	12.4 to 18 GHz	12.4 to 18 GHz
050	50 dB		
060	60 dB		

1-41. Line Lengths

1-42. Rigid, air dielectric, coaxial line sections of 10 and 20 centimeters are available for making transmission measurements on devices physically longer than the 15-cm extension of the Model 8740A. These line sections, designated 11566A for the 10-cm length and 11567A for the 20-cm length, have APC-7 connectors.

A-43. Loads.

1-44. Fixed Load. The Model 909A is a 50-ohm coaxial termination with APC-7 connector for use with the Models 8741A, 8742A, 8743A, 8745A, and 8746B Test Units.

1-45. Sliding Load. The Model 905A or 907A is a movable load in a 50-ohm coaxial line that has an APC-7 connector. The sliding load is useful for improving the accuracy of reflection measurements above 1.8 GHz.

1-46. Shorts

1-47. The 11511A Type N Shorting Jack, the 11512A Type N Shorting Plug, and 11565A APC-7 short can be used with the reflection test units for calibrating reflectometer measurements.

1-48. DISPLAY UNITS

1-49. All plug-in display units designated for use with the Model 8410B are completely interchangeable. These units are powered by the Model 8410B with all necessary interconnections made automatically when the unit is properly installed. Markers and display blanking inputs are provided by the source.

1-50. Model 8412A Phase-Magnitude Display. Intended for fixed- and swept-frequency transmission or reflection measurement, the Model 8412A provides phase and magnitude information on an oscilloscope. Phase can be displayed at 1, 10, 45, and 90 DEG/Division. A phase offset switch offsets the display in 20 degree steps from −180 degrees to +180 degrees. Magnitude can be displayed at 0.25, 1, 2.5, and 10 dB/Division. Analog voltages for both phase and magnitude are available at rear output jacks. The analog voltages can be used to obtain calibrated plots of phase angle and amplitude ratio against frequency on graphic recorders.

1-51. Model 8413A Phase-Gain Indicator. Intended for fixed- and swept-frequency transmission or reflection measurements, the Model 8413A provides phase and amplitude information in two forms: meter indication and analog voltage. The meter indicates phase or amplitude according to the function selected, while the analog voltages continuously monitor both phase and amplitude. The meter has center-zero scales with phase ranges of ±6°, ±18°, ±60°, and ±180° and amplitude ranges of ±3, ±10, and ±30 dB. Calibrated phase offsets in 10 degree steps allow any phase angle to be read on the best-resolution range of ±6°. The analog voltages can be used to obtain

calibrated plots of phase angle and amplitude ratio against frequency on conventional two-trace oscilloscopes or graphic recorders.

1-52. Model 8414A Polar Display. The Model 8414A is used for transmission (gain, attenuation) and for reflection measurements (impedance, admittance, reflection coefficient, return loss). It displays linear magnitude ratio and phase in polar form on a built-in cathode ray tube, and provides simultaneous voltages proportional to the amplitude and phase components of the display. Supplied Smith Chart graticule overlays permit impedance and admittance to be read directly from the display.

1-53. A ground modification has been made on the Model 8414A plug-in that affects interchangeability between the units. Table 1-6 shows the units that will work together. As shown in the table, modification kit no. HP 08414-6022 may be added to the 8414A with serial numbers 749-00215 and below to make it compatible with any 8410B.

Table 1-6. Models 8410B and 8414A Compatibility by Serial Number

8414A	Mates with 8410B
802-00216 and above	All
749-00215 and below with HP Part No. 08414-6022 Modification Kit installed.	All

1-54. AUXILIARY EQUIPMENT.

1-55. Transmission and Reflection Test Units

1-56. For added convenience in making transmission and reflection measurements, auxiliary signal separating units are available. These compact, portable modules contain the passive devices required to divide a test signal into two signals for magnitude and phase comparison.

1-57. Model 8740A Transmission Test Unit. The transmission test unit divides a test signal into the two channels required for transmission measurements. It includes a calibrated line stretcher and a calibrated extension line with separate digital counters for measuring the mechanical and electrical lengths of the network being tested. APC-7 output connectors on the measuring channels are spaced to match the inputs of the Model 8411A Harmonic Frequency Converter. The test unit covers the frequency range of the network analyzer up to 12.4 GHz.

1-58. Models 8741A and 8742A Reflection Test Units. Two reflection test units cover the frequency range of the network analyzer up to 12.4 GHz. Model 8741A spans 0.11 to 2 GHz, and the Model 8742A covers 2 to 12.4 GHz. They contain broadband directional couplers and a calibrated line stretcher. The line stretcher is for equalizing the electrical distance from the test signal input to the incident and reflected signal outputs. It can also be used to move the plane of measurement as much as 14 cm for the Model 8741A and 16.5 cm for the Model 8742A. A digital counter registers line length with 0.1 mm resolution. APC-7 connectors are used on the test unit output ports, compatible type N on the input port. An HP Model 11565A APC-7 short is a furnished accessory with each 8741A and 8742A.

1-59. Model 8743A Reflection-Transmission Test Unit. This reflection-transmission test unit divides a signal into two channels for amplitude and phase comparison. Pushbuttons select either transmission or reflection measurement. It includes a line stretcher with a digital counter. This unit covers the frequency range from 2.0 to 12.4 GHz (2.0 to 18 GHz for Option 018).

1-60. Model 8745A S-Parameter Test Set. The most convenient way to measure S-parameters in the 0.1 to 2 GHz frequency range is with the HP Model 8745A S-Parameter Test Set. This test set combines in one unit all the coaxial switches, directional couplers, bias networks, and signal-path length compensators (line stretchers) that are required for S-parameter measurements. After a simple calibration, all four S-parameters can be measured without disconnecting and reconnecting the device under test. Measurement circuits for each S-parameter are automatically connected by pressing the appropriate front-panel pushbuttons or by remote contact closures.

1-61. Model 8746B S-Parameter Test Set. The HP Model 8746B contains the necessary microwave circuits for measuring all four S-parameters of an active or passive two-port device from 0.5 to 12.4 GHz. The Model 8746B is designed primarily to be used with the Hewlett-Packard Model 11608A Transistor Fixture. However, measurements on other microwave devices may also be made by inserting the necessary coaxial line-lengths in the rear panel reference line. Measuring circuits for each S-parameter are automatically set with front-panel pushbuttons or with remote-contact closures. Attenuation of the incident RF signals, in 10-dB steps, can also be set with front-panel pushbuttons or with remote contact-closures.

1-62. Accessories are available which suit various kinds of two-port devices. The 11604A Universal Extension, with its pivoting air-line extensions and swivelling connectors, allows many kinds of non-axial connector devices to be connected to the test set. The 11600B and 11602B Transistor Fixtures adapt the 8745A test set ports for measurements of transistors. The 11600B is for TO-18/TO-72 base patterns, and the 11602B is for TO-5/TO-12 base patterns. The fixtures mount on the front of the test set. Measurements can be made on both bipolar and FET transistors in all of their common operating configurations, using the snap-on dials furnished with the fixture to accomodate the various lead orientations. The 8717B Transistor Bias Supply can be connected to the test set to apply and sense dc bias. The fixtures and their dials can also be used to make measurements on components such as capacitors, inductors, and diodes.

1-63. Models X8747A/P8747A Transmission and Reflection Test Unit. This waveguide transmission and reflection test unit divides a test signal into two channels for amplitude and phase comparison. This unit permits testing waveguide components with the coaxial network analyzer. It includes a calibrated line stretcher. The X8747A covers from 8.2 to 12.4 GHz, while the P8747A covers from 12.4 to 18.0 GHz. An Option 018 8411A is necessary to operate in P-band.

1-64. Model K8747A/R8747A Transmission and Reflection Test Unit. This waveguide transmission and reflection test unit divides a test signal into two channels for amplitude and phase comparison. This unit permits testing waveguide components with the coaxial network analyzer. It includes a calibrated line stretcher. The K8747A covers the 18 to 26.5 GHz band in frequency segments up to 2 GHz wide, while the R8747A covers the 26.5 to 40 GHz band in 2 Ghz segments.

1-65. Model 8418A Auxiliary Display Holder. The 8418A Auxiliary Display Holder provides a means of utilizing two different types of phase-magnitude display units simultaneously (i.e. polar and rectangular displays). The 8418A contains a power supply and phase and amplitude controls for referencing an auxiliary display unit (8412A, 8413A, or 8414A) to a display indicator in the 8410B.

1-66. Signal Sources. The HP Model 8620C Sweep Oscillator, with its series of RF Plug-ins, is the recommended swept source for the 8410B-based network analyzer system. The 8620C is compatible with the 8410B AUTO sweep range capability when the Source Interconnect Cable is connected. The Source Interconnect Cable provides a digital interface between the sweeper and network analyzer to control the sweep at the receiver phase lock acquistion points and sweeper band switch points. The 8620C is also HP-IB compatible, and may be used in automatic system applications.

1-67. A wide choice of single-band and multi-band RF Plug-ins is available for use with the 8620C. For an 8410B-based network analyzer system using the 8745A S-Parameter Test Set, the 86222B provides single sweep coverage of the 110 MHz to 2.0 GHz frequency range of the system. The 86290B features a 10 mW output power over the full 2.0 to 18.0 GHz band of the 8743A Reflection-Transmission Test Unit.

1-68. SIGNAL SOURCE REQUIREMENTS

1-69. Output Power

1-70. Range. About −6 to + 10 dBm is adequate for both wide range attenuation measurements and reflection measurements.

1-71. Stability. Output power must be constant enough across the frequency range being swept to hold an OPERATE indication on the REF CHANNEL LEVEL meter. The REF CHANNEL LEVEL meter will stay in the OPERATE range for the following input power levels: −18 to −35 dBm (11 to 12.4 GHz) and −18 to −25 dBm (12.4 to 18 GHz; Option 018).

1-72. Signal Purity

1-73. To prevent the analyzer from mistuning, spurious signal output should be greater than approximately 25 dB below the desired frequency.

1-74. Frequency Stability

1-75. Of chief importance to the tuning and tracking of the network analyzer are the influences on frequency stability and rate of change of frequency. Among these are residual FM and susceptibility to radiated interference, power line conducted interference, and power line transients.

1-76. Sweep Characteristics.

1-77. Swept signal sources should have uniform tuning rate and sweeping time that is variable between about 15 and 150 MHz per millisecond. RF blanking should not be used in order to keep the network analyzer in phase lock during retrace. An additional important requirement is a pause between sweeps. There should be at least a 3 millisecond pause at the start frequency prior to each sweep in order to allow the network analyzer to lock initially.

1-78. The rate of change of frequency must not exceed the tracking ability of the Network Analyzer. With proper sweep reference voltage (see paragraph 1-79), the network analyzer should remain phase-locked with sweep speeds of about 35 milliseconds/octave from 0.11 to 18 GHz.

1-79. Frequency-Related Voltage Output

1-80. For fastest swept-frequency measurements, the signal source should furnish a voltage proportional to output frequency. This voltage enables the network analyzer to track at its highest rate. A 1V/GHz Frequency Reference voltage is supplied by the RF plug-in of the 8620A/C Sweep Oscillator. The requirements for this voltage are that it be positive in polarity and in direct proportion (1V/GHz) to the signal source output frequency.

1-81. ADAPTING HEWLETT-PACKARD SWEEP OSCILLATORS FOR USE WITH THE NETWORK ANALYZER.

1-82. 8620A Sweep Oscillator with RF Plug-in.

1-83. While all 8620 Sweep Oscillators and RF Plug-in units are fully compatible with the 8410B for octave sweeps, early versions do not incorporate the complete multi-octave sweep capability. Table 1-7 gives a serial number breakdown of the 8620A/C Sweep Oscillator and RF plug-ins that are compatible for 8410B AUTO mode multi-octave operation. Instruments with serial prefixes, or numbers, lower than those listed in Table 1-7 require a service kit and modification. For Service Note and Modification Kit part numbers, contact the local Hewlett-Packard Field Office.

Table 1-7. AUTO Tune/Source Compatibility

HP Model Number	Instrument Serial Prefix or Number
8620C (Mainframe)	All
8620A (Mainframe)	1427A01876 and above.
86290A/B	All
Other RF plug-ins	1506A and above.

1-84. An 8620A Sweep Oscillator modified for compatibility with the 86290A RF plug-in needs an additional modification for compatibility with the 8410B in AUTO mode operation. This modification provides a path for the Stop Sweep signal from the 8410B, and consists of a jumper between 8620A-J7 (A17) and 8620A-J2 (27). If the jumper is installed, then grounding 8620A-J2 (27) will stop the 8620A Sweep Oscillator from sweeping.

1-85. RECOMMENDED TEST EQUIPMENT

1-86. Equipment required for performance testing, adjustment, and troubleshooting of the Hewlett-Packard Model 8410B/8411A Network Analyzer is listed in Table 1-8. Other equipment may be substituted if it meets or exceeds the critical specifications listed in the table.

Table 1-8. Recommended Test Equipment for Performance (Sheet 1 of 3)

Ref. No.	Instrument	Critical Specifications	Use (Note 1)	Recommended HP Model
1	Sweep Oscillator RF Plug-In	Frequency Range: 0.11 to 18 GHz	P, A, T	8620C/86222A (0.11 to 2.0 GHz) 8620C/86290A/B (2 to 18 GHz)
2	Power Meter & Thermistor Mount	Frequency Range: 0.11 to 18 GHz Power Range: +5 to −15 dBm Instrument Accuracy: ±3% Input Impedance: 50 ohms Connector: APC-7	P, A, T	432A with 8478B Option 011 Thermistor Mount
3	AC Voltmeter	Accuracy: ±1% Range: 500 μV to 10 VRMS Meter Scale: dB Input Impedance: 10 megohms Frequency: 278 kHz	P	400EL 400FL
4	Transmission or Reflection Test Unit	No substitute may be used	A, T	8740A 8741A 8742A 8743A 8745A
5	Dual Trace Oscilloscope with 10:1 probes	Vertical Amplifier: Dual Trace Bandwidth: 100 MHz minimum Horizontal Sweep Rate: 200 ns/cm expanded to 20 ns/cm Vertical Sensitivity: 5 mV/cm	A, T	1740A
6	Spectrum Analyzer	Frequency Range: 0.11 to 18 GHz Sensitivity: 1 mV/cm	T	8565A
7	Reflectometer System (Swept Amplitude Analyzer & Reflectometer Bridge)	No substitute may be used	P	8755B/182T 11666A 8750A
8	Frequency Counter	Frequency Range: 10 Hz to 18 GHz Accuracy: ±0.2% Display: 4 digits minimum	A, T	5340A
9	Dual DC Power Supply	Outputs: 0 to 40 Vdc 0-300 mVdc	A, T	6205B
10	Display Plug-in for 8410B	No substitute may be used	P, A, T	8412A

Table 1-8. Recommended Test Equipment for Performance (Sheet 2 of 3)

Ref. No.	Instrument	Critical Specifications	Use (Note 1)	Recommended HP Model
11	Digital Multimeter	Accuracy: 0.05% Input Impedance: 10 megohms minimum Range: to 150V	A, T	3490A
12	DC Electronic Voltmeter	Accuracy: ±3% of full scale Input Impedance: 10 megohms minimum Range: to ±100 volts	A, T	427A
13	Low Frequency Signal Source (278 kHz)	Frequency Range: 200 to 400 kHz	A, T	3312A
14	Power Splitter	Frequency Range: 0.11 to 18 GHz	P, A, T	11667A
15	20 dB Fixed Attenuator	Attenuation: 20 dB nominal	A, T	8491A/B, Option 20
16	10 dB Fixed Attenuator (2 required)	Attenuation: 10 dB nominal Frequency Range: 0.11 to 18 GHz SWR: 1.35 maximum Connectors: APC-7	P, A, T	8492A, Option 10 (Note 2)
17	Fixed Air Line	50-ohm, 20 cm air line with APC-7 connectors	A, T	11567A (Note 2)
18	50-ohm Load	50-ohm termination with APC-7 connectors	P, A, T	909A
19	Adapters	50-ohm adapter (APC-7 to male type N)	P, A, T	11525A (Note 2)
20	Adapter (2 required)	50-ohm adapter (APC-7 to female type N)	P, A, T	11524A (Note 2)
21	Short	50-ohm short (APC-7 connector)	P, A, T	11565A (Note 3)
22	50-ohm Feedthru	50-ohm termination Connectors: male BNC and female subminiature	A	11048B (with adapter 1250-0831)
23	RF Cable (3 required)	9-inch cable with Type N connectors	P, A, T	8120-2289
24	RF Cable	24-inch cable with Type-N connectors	P, A, T	8120-2292

Table 1-8. Recommended Test Equipment for Performance (Sheet 3 of 3)

Ref. No.	Instrument	Critical Specifications	Use (Note 1)	Recommended HP Model
25	Source Control Cable	No substitute may be used	P, A, T	8620C 8120-2208 8620A 08410-60115
26	1 dB Step Attenuator	DC to 18 GHz Type N Connectors	P, A	8494B
27	10 dB Step Attenuator	DC to 18 GHz Type N Connector	P, A	8495B
28	Adapter	Type N Male-Male	P, A	1250-0778
29	Adapter	Type N Female-Female	A	1250-0777
30	Adapter (2)	Type N Male to BNC Female	A	1250-0780
31	Adapter	Sealectro SMC Male-Male	A	1250-0827
32	Adapter Cable (2)	36" Cable SMC Female to BNC Male	A	11592-60001
33	Test Covers for 8411A	No substitute may be used	A	08411-60035
34	APC-7 Contact Extractor Tool	No substitute may be used.	R	5060-0236 (Notes 2 and 4)
35	APC-7 Spanner Wrench	No substitute may be used.	R	5060-0237 (Notes 2 and 4)
36	Open End Wrench 9/16" X 1/2"	Thickness: 3/32" maximum	R	8710-0877 (notes 2 and 4)
37	Burndy Extractor Tool	Burndy Part No. Rx20-25 V2	R	None

1. P = Performance; A = Adjustment; T = Troubleshooting; R = Repair.
2. Part of HP 11587A Accessory Kit.
3. Furnished with HP 8741A and 8742A.
4. Part of HP 11591A APC-7 Connector Tool Kit.

SECTION II
INSTALLATION

2-1. INITIAL MECHANICAL INSPECTION

2-2. If external damage to the shipping carton is evident, ask the carrier's agent to be present when the instrument is unpacked. Check the instrument for external damage such as broken controls or connectors, and dents or scratches on the panel surface. If damage is evident, refer to Paragraph 2-5 for recommended claim procedure and repackaging information. If the shipping carton is not damaged, check the cushioning material and note any signs of severe stress as an indication of rough handling in transit. If the instrument appears undamaged, check for all supplied accessories, then perform the electrical check (paragraph 2-3).

2-3. INITIAL ELECTRICAL INSPECTION

2-4. Check the electrical performance of the network analyzer as soon as possible after receipt by performing the Performance Test (Paragraphs 4-12 through 4-18). The Performance Test procedure compares the electrical performance to the specifications of Table 1-1. This test is also suitable for incoming quality control inspection. If the network analyzer does not perform within the specifications when received, refer to Paragraph 2-5 for recommended claim procedure and Paragraph 2-7 for repackaging information.

2-5. CLAIMS

2-6. If physical damage is evident, or if the instrument does not meet specifications when received, notify the carrier and the nearest Hewlett-Packard Sales and Service Office. (See list at rear of manual.) The Sales and Service Office will arrange for repair or replacement without waiting for settlement of a claim with the carrier.

2-7. REPACKAGING FOR SHIPMENT

2-8. Using Original Packaging

2-9. The same containers and materials used in factory packaging can be obtained through the Hewlett-Packard offices listed at the rear of this manual. If the Model 8410B or Model 8411A is being returned to Hewlett-Packard for servicing, attach a tag indicating the type of service required, return address, model number, and full serial number. Also mark the container FRAGILE to assure careful handling. In any correspondence, refer to the instrument by model number and full serial number.

2-10. Using Other Packaging

2-11. The following general instructions should be used when repackaging with commercially available materials:

a. Wrap the instrument in heavy paper or plastic. (If shipping to a Hewlett-Packard service office or center, attach a tag indicating the type of service required, the return address, model number, and full serial number.)

b. Use a strong shipping container. A double-wall carton made of 350 pound test material is adequate.

c. Use enough shock-absorbing material (3-to 4-inch layer) around all sides of the instrument to provide firm cushion and prevent movement inside the container. Protect the control panel with cardboard.

d. Seal the shipping container securely, and mark it FRAGILE to assure careful handling.

e. In any correspondence refer to the instrument by model number and full serial number.

2-12. PREPARATION FOR USE

2-13. Power Requirements

2-14. The 8410B requires a power source of 100, 120, 220, or 240 volts ac +5% − 10%, 50 to 60 Hz, single phase. Power output should be capable of 85 watts when the 8413A Phase-Gain Indicator plug-in is installed, and 105 watts when a CRT display plug-in is installed (8412A rectangular display or 8414A Polar display).

2-15. Line Voltage Selection

2-16. Figure 2-1 provides instructions for line voltage and fuse selection. A set of fuses is supplied with the instrument.

CAUTION

To prevent damage to the instrument, make the line voltage selection before connecting line-power.

2-17. Power Cable

2-18. To protect operating personnel, the National Electrical Manufacturers' Association (NEMA) recommends that instrument panels and cabinets be grounded. Accordingly, the Model 8410B is equipped with a three-conductor power cable which, when plugged into an appropriate receptacle, grounds panel and cabinet. The offset pin of the three-prong connector is the grounding pin. (See Table 2-1.)

2-19. When operating the Model 8410B from a two-contact outlet, the protecting feature may be preserved by using a three-prong to two-prong adapter (HP Stock No. 1251-0048) and connecting the green wire of the adapter to ground.

2-20. Bench Operation

2-21. The Model 8410B cabinet has plastic feet and a foldaway tilt stand for convenience in bench operation. The stand inclines the instrument enough to make the panel features easy to see. The plastic feet provide clearance for air circulation and make the Model 8410B self-aligning when stacked on other Hewlett-Packard full rack-width modular instruments.

2-22. Rack Mounting

2-23. Preparation for rack-mounting is illustrated in Figure 2-2. All necessary hardware is contained in the available rack-mounting kit (HP Stock No. 5060-8741). This rack-mounting kit is supplied with Option 908 instruments.

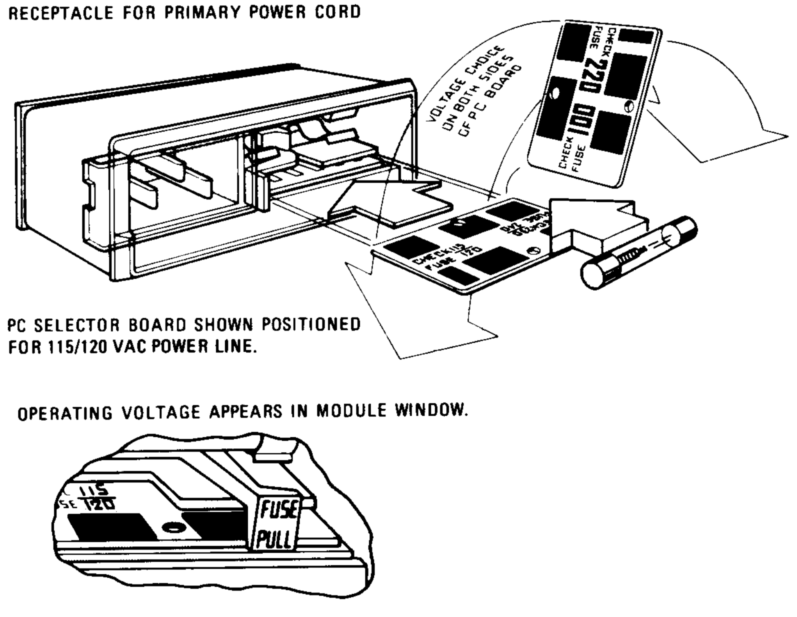
2-24. Connecting the Model 8411A

2-25. To connect the Model 8411A to the Model 8410B:

a. Set the Model 8410B LINE to off (push-button not lighted).

b. Hold the Model 8411A cable connector so that the head of the screw in the connector body enters the slot in the top of the Model 8410B INPUT connector and push the connectors firmly together.

c. Tighten the coupling ring securely.

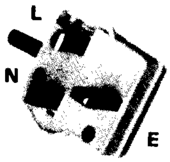
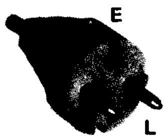
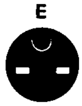


SELECTION OF OPERATING VOLTAGE

1. Slide open power module cover door and push FUSE PULL lever to left to remove fuse.
2. Pull out voltage-selector PC board. Position PC board so that voltage nearest actual line voltage level will appear in module window. Push board back into its slot.
3. Push FUSE PULL lever into its normal right-hand position.
4. Check fuse to make sure it is of correct rating and type for input AC line voltage. Fuse ratings for different line voltages are indicated below power module.
5. Insert correct fuse in fuseholder.

Figure 2-1. Line Voltage Selection

Table 2-1. AC Power Cables Available

Plug Type **	Cable HP Part Number	C D	Plug Description	Cable Length cm (inches)	Cable Color	For Use In Country
250V  L N E	8120-1351 8120-1703	0 6	Straight*BS1363A 90°	229 (90) 229 (90)	Mint Gray Mint Gray	United Kingdom, Cyprus, Nigeria, Rhodesia, Singapore, So. Africa, India
250V  E L N	8120-1369 8120-0696	0 4	Straight*NZSS198/ ASC112 90°	201 (79) 221 (87)	Gray Gray	Australia, New Zealand
250V  E L N	8120-1689 8120-1692	7 2	Straight*CEE7-Y11 90°	201 (79) 201 (79)	Mint Gray Mint Gray	East and West Europe, Saudi Arabia, Egypt (unpolarized in many nations)
125V  E N L	8120-1348 8120-1398 8120-1754	5 5 7	Straight*NEMA5-15P 90° Straight*NEMA5-15P	203 (80) 203 (80) 91 (36)	Black Black Black	United States, Canada, Japan (100 or 200V), Mexico, Philippines, Taiwan
	8120-1378 8120-1521 8120-1676	1 6 2	Straight*NEMA5-15P 90° Straight*NEMA5-15P	203 (80) 203 (80) 91 (36)	Jade Gray Jade Gray Jade Gray	
250V  N L E	8120-2104	3	Straight*SEV1011 1959-24507 Type 12	201 (79)	Gray	Switzerland
250V E 	8120-0698	6	Straight*NEMA6-15P			
250V E 	8120-1860	6	Straight*CEE22-VI			

* Part number shown for plug is industry identifier for plug only. Number shown for cable is HP Part Number for complete cable including plug.

** E = Earth Ground, L = Line; N = Neutral

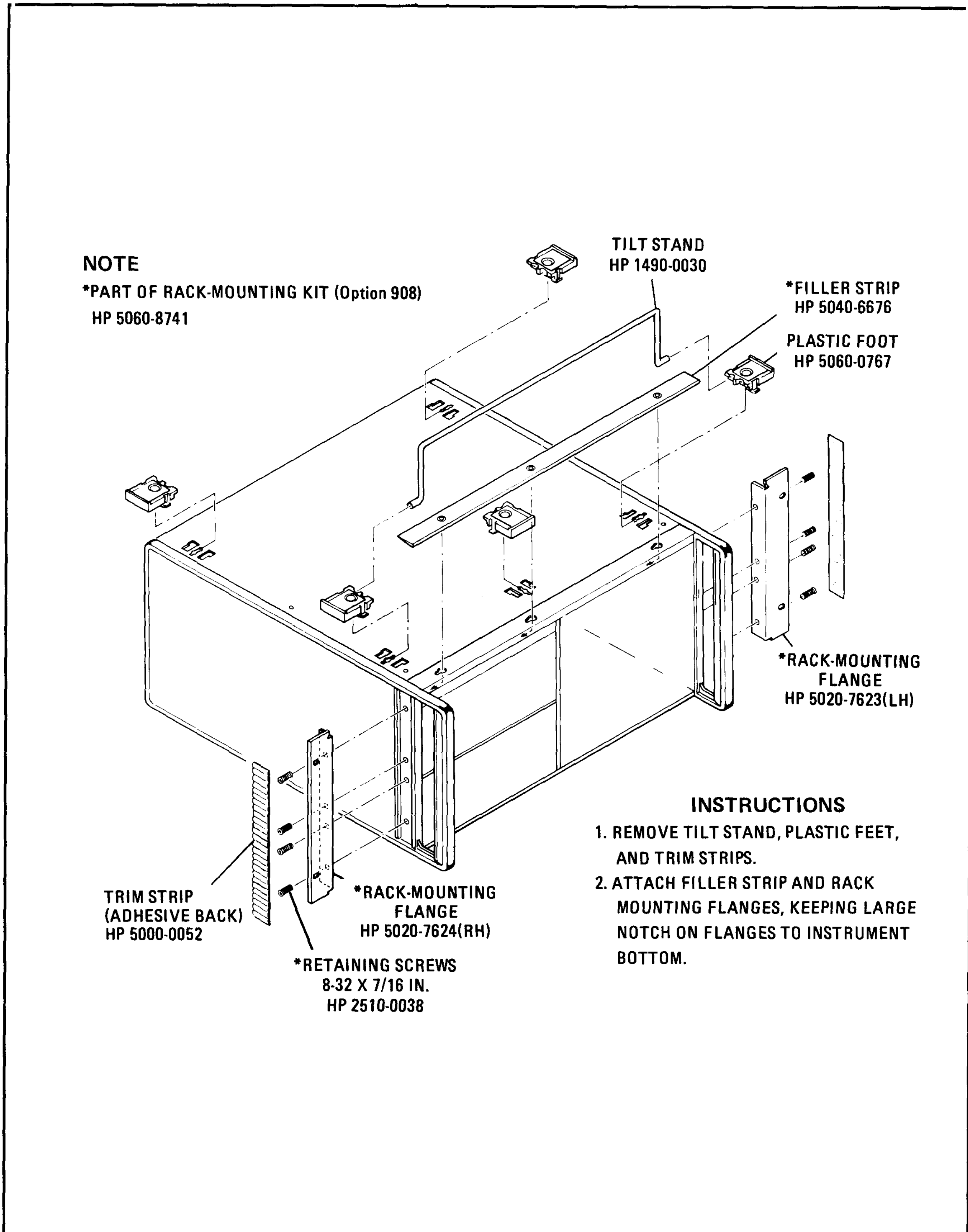


Figure 2-2. Rack-Mounting Kit Installation

2-26. INSTALLING A DISPLAY UNIT.

2-27. To install a plug-in display unit:

a. Set Model 8410B LINE switch to off (pushbutton not lighted).

b. Press down on the extractor-retainer lever latch and swing the lever outward to its mechanical stop.

c. Rest the rear feet of the display unit on the bottom of the plug-in compartment, then slide the plug-in toward the back of the compartment until the extractor-retainer lever starts to move.

d. Pivot the extractor-retainer lever back to its closed and latched position. All necessary electrical connections between the display unit and Model 8410B are made automatically.

2-28. CARE OF INPUT CONNECTORS

2-29. RF signals are coupled into the Model 8411A through 50-ohm, 7-mm APC-7 coaxial connectors. These connectors should be handled with particular care for two main reasons: (1) continuity through APC-7 connectors is obtained by end-to-end contact of the inner and outer conductors; consequently, the electrical performance of the connector is largely dependent upon the condition of these exposed surfaces, and (2) the critical contacting surfaces are directly attached to the vital frequency converter units inside the Model 8411A and are not separately replaceable.

2-30. Important recommendations for the handling and care of the input connectors are given in Figure 2-3. The part of an input connector that is most likely to be damaged is the inner conductor contact. Since it protrudes slightly beyond the plane of electrical contact, any wiping action of one connector across the other can damage the contact enough to cause a discontinuity. The risk of this kind of damage can be minimized by always having the coupling sleeves on the Model 8411A connectors fully extended.

2-31. Contact Replacement

2-32. Replacement inner conductor contacts are available from Hewlett-Packard (Stock Number 1250-0907), and from Amphenol RF Division, Danbury, Connecticut (Part Number 131-129).

2-33. The following important precautions apply to the replacement of inner conductor contacts:

a. Do not apply more than slight inward pressure to the inner conductor.

b. Do not apply ANY twisting force to the inner conductor.

c. Do not attempt to repair contacts.

d. Do not re-use contacts.

CAUTION

Inward pressure or twisting force applied to the inner conductor can render the Model 8411A inoperative.

2-34. Because of the above considerations, contact removal should not be attempted with ordinary hand tools. Only the Hewlett-Packard self-positioning, hypodermic-action contact extractor tool (Stock No. 5060-0236) should be used. This tool exerts no appreciable inward pressure and no twisting force on the inner conductor. Instructions for removing contacts are supplied with the tool.

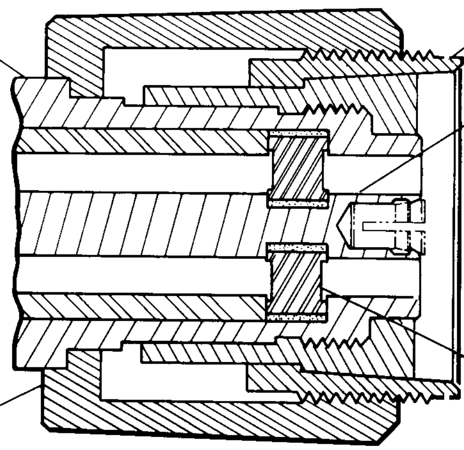
2-35. No tool is required for installing a replacement contact. Insert the contact gently by hand, applying only enough inward pressure to snap it into place. Then check for proper installation by inspecting the contact for even spacing of its four segments. Also, test for normal spring action by applying light inward pressure against the end of the contact with a pencil eraser. As the pressure is released the spring action of the contact should cause it to move outward. If not, the contact is defective and should be replaced.

2-36. Coupling Mechanisms

2-37. The coupling mechanism includes the coupling nut and the two-piece coupling sleeve assembly shown in Figure 2-3. Both of these parts can be replaced without access to the inside of the Model 8411A, and without disturbing either of the conductors. A special spanner wrench, HP Stock Number 5060-0237, is required. This wrench is included in Accessory Kit 11587A and APC-7 Connector Tool Kit 11591A.

2-38. To remove a coupling mechanism:

a. Fully extend the coupling sleeve to provide a guide for the spanner wrench.



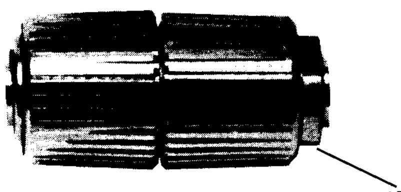
Use

To Connect:

1. On one connector, retract the coupling sleeve by turning the coupling nut counterclockwise until the sleeve and nut disengage.
2. On the other connector, fully extend the coupling sleeve by turning the coupling nut clockwise. To engage coupling sleeve and coupling nut when the sleeve is fully retracted, press back lightly on the nut while turning it clockwise.
3. Push the connectors firmly together, and thread the coupling nut of the connector with retracted sleeve over the extended sleeve. Leave the other coupling nut in the original position; closing the gap between coupling nuts tends to loosen the electrical connection.

To Disconnect:

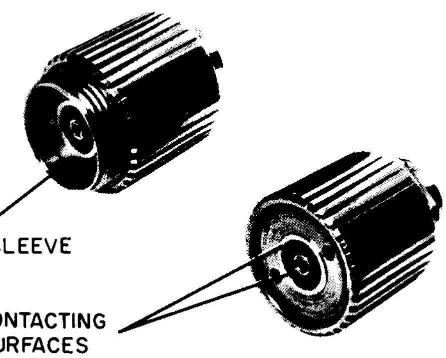
1. Loosen the coupling nut of the connector showing the wider gold band.



2. IMPORTANT: Part the connectors carefully to prevent striking the inner conductor contact.

CARE

1. Keep contacting surfaces smooth and clean. Irregularities and foreign particles can degrade electrical performance.



2. Protect the contacting surfaces when the connector is not in use by leaving the coupling sleeve extended.
3. Use lintless material and/or firm-bristled brush such as toothbrush for cleaning. If a cleaning fluid is needed use isopropyl alcohol. IMPORTANT: Do not use aromatic or chlorinated hydrocarbons, esters, ethers, terpenes, higher alcohols, ketones, or ether-alcohols such as benzene, toluene, turpentine, dioxanne, gasoline, cellosolve acetate, or carbon tetrachloride. Expose the connector parts to the cleaning fluid and its vapors as briefly as possible.

Figure 2-3. APC-7 Connectors

b. Align the wrench so both pegs engage the holes in the end of the coupling sleeve assembly.

c. Pressing the wrench firmly against the connector, unscrew the sleeve assembly by turning the wrench counterclockwise.

2-39. When installing a coupling mechanism, set the coupling nut in place on the connector first, then thread on the coupling sleeve assembly and tighten it firmly with the spanner wrench. (Extending the coupling sleeve helps to keep the spanner in position during the final tightening.

2-40. POWER SWITCH LAMP REPLACEMENT

2-41. The lamp housed in the POWER switch pushbutton indicates that line power is applied to the Model 8410B. To replace the lamp, pull out the pushbutton, and remove the lamp. The HP Stock Number for a replacement lamp is listed under DS1 in the Table of Replaceable Parts.

2-42. OPERATORS QUICK-CHECK PROCEDURE

2-43. The following procedure checks the overall functional operation of the 8410B and 8411A system, but does not check calibration.

a. Connect equipment as shown in Figure 2-4.

b. Set signal source for single-frequency CW operation, any frequency from 110 MHz to 12.4 GHz.

c. Set the 8410B FREQ RANGE switch to a position that includes the signal source frequency.

d. Set 8410B SWEEP STABILITY control to CW detent position.

e. Slowly increase signal source power until the 8410B REF CHANNEL LEVEL meter indicates in the OPERATE range.

f. Set TEST CHANNEL GAIN for a convenient TEST CHAN indication on the 8412A display.

g. Set 8412A MODE switch to PHASE and DEG/DIV switch to 90. Adjust the PHASE VERNIER control. The dot on the CRT should be stable and move smoothly in a vertical direction.

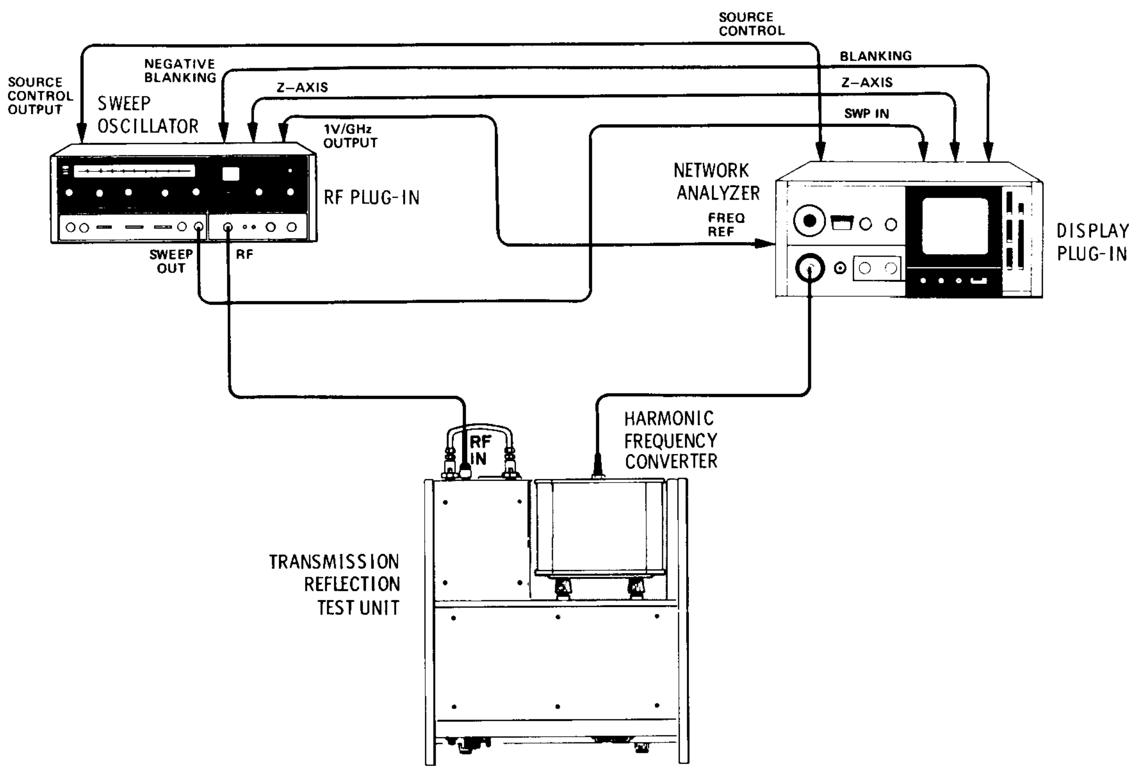


Figure 2-4. Test Setup for Operators Quick Check

SECTION III
OPERATION

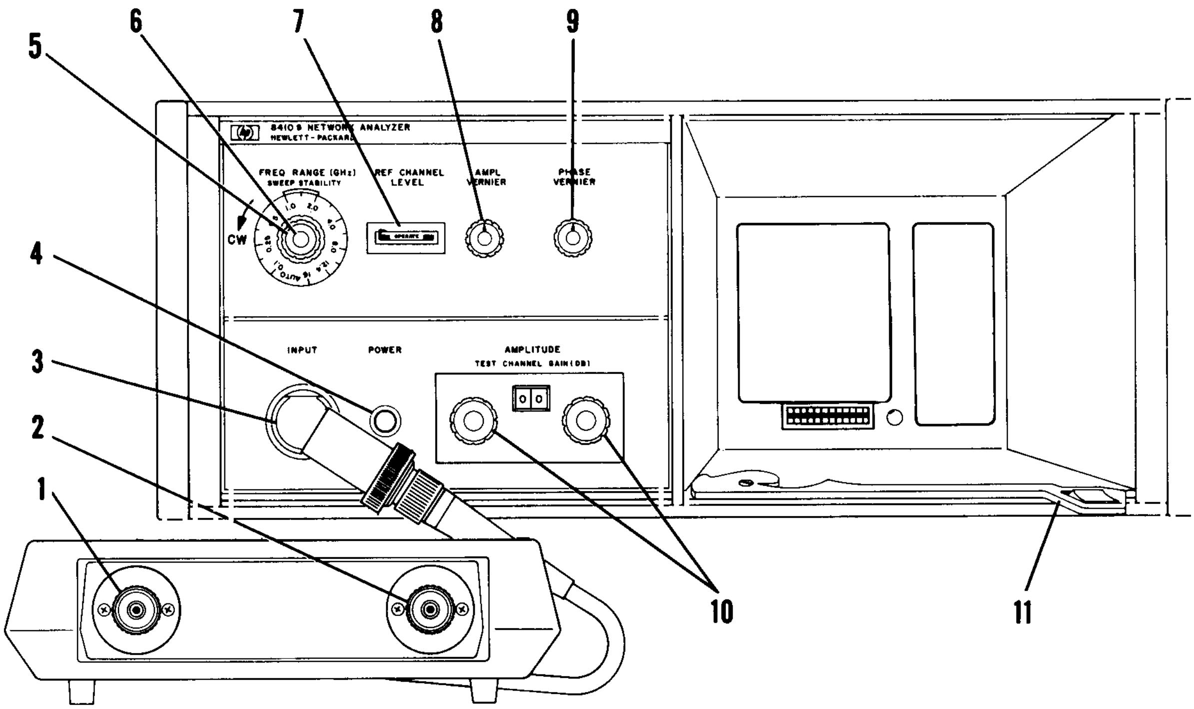
3-1. INSTRUCTIONS FOR MAKING MEASUREMENTS

3-2. Step-by-step instructions for making basic transmission and reflection measurements with the 8410B/8411A are found in Application Note AN 117-1 included with your instrument. Additional copies may be obtained from your nearest Hewlett-Packard Office.

3-3. A typical test setup for multioctave measurements is shown in Figure 3-3. This test setup uses an 8620C/86222A for the 0.11 to 2 GHz range and an 8620C/86290A/B for the 2 to 18 GHz range.

3-4. DESCRIPTIONS OF PANEL FEATURES

3-5. Front and rear panel controls, connectors, and indicators are described in Figures 3-1 and 3-2. In these figures the numbers on the illustrations match the description numbers.



1. **TEST.** Test channel input. Impedance 50 ohms. Frequency range: 0.11 - 12.4 GHz (Option 018: 0.11 to 18 GHz). Input power: −10 dBm maximum, not to exceed reference channel power by more than 20 dB. Dynamic range: at least 60 dB. Admits frequency to which reference channel is tuned. Connector is precision APC-7. [1,2]

2. **REFERENCE.** Reference channel input. Impedance: 50 ohms. Frequency range: 0.11 - 12.4 GHz (Option 018:0.11 to 18 GHz). Internal auto-tuning tunes and tracks REFERENCE and TEST channel inputs to the frequency of the REFERENCE input. Required input levels lie in a range between −18 and −35 dBm to 12.4 GHz and −18 to −25 dBm from 12.4 to 18 GHz (for Option 018). Input power is in this range when the REF CHANNEL LEVEL meter indicates in the OPERATE region. Connector is precision APC-7. [1,2]

CAUTION

8411A INPUT

- **Maximum input power: 50 mW (damage level).**
- **Maximum dc on RF line: ±3 volts (damage level).**
- **Static Discharge: Static charge on cables being connected to the input can damage the Model 8411A.**
- **Do not twist the APC-7 inner conductor.**

Figure 3-1. Front Panel Features (Sheet 1 of 2)

3. **INPUT.** 8410B connector mates with 8411A Harmonic Frequency Converter cable.

4. **POWER.** Combination line power switch and power indicator. Pushbutton glows when instrument is on. Pushbutton retainer pulls out for lamp replacement (Paragraph 2-40).

5. **FREQ RANGE (GHz).** Automatic or manual frequency range selection control. In AUTO position, the 8410B monitors the source through the Source Interconnect Cable and automatically selects the proper frequency range. Particular frequency ranges can be selected. Selected range must include the frequency (or frequencies) at which measurements are to be made. The dial is marked to indicate that an 8411A Option 018 is required for frequency ranges above 12.4 GHz.

6. **SWEEP STABILITY.** Fine tuning control. Adjusts for best automatic tuning. A CW detent at the fully counterclockwise position gives best auto-tuning for single frequency CW-mode operation. For swept measurements, this control is typically set to the l o'clock position.

7. **REF CHANNEL LEVEL.** Meter indicates amplitude of signal applied to Model 8411A reference channel input. Pointer should be in OPERATE region for all phase and magnitude measurements. Because the meter averages in RF power during the automatic relocking cycle and sweeper retrace, the meter level should be set with a slow sweep rate.

8. **AMPLITUDE VERNIER.** Uncalibrated test channel gain vernier with at least 2 dB continuous range. Gain increases with clockwise rotation.

9. **PHASE VERNIER.** Continuous control for changing relative phase of reference and test channel signals. Range is at least 90°, uncalibrated.

10. **AMPLITUDE.** Precision 69 dB test channel gain control. Left hand control has 0 to 60 dB range in 10-db steps. Right hand control has 0 to 9 dB range in 1-dB steps.

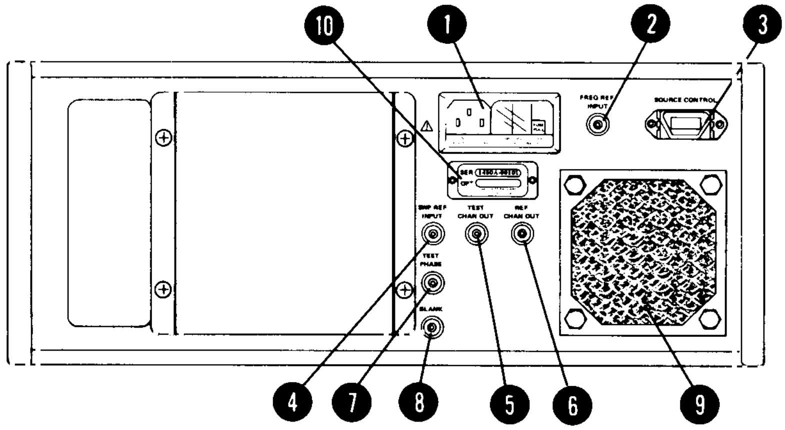
11. Pivoting lever installs, retains, and extracts plug-in display units.

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[1] See Paragraph 2-28 for important instructions and information on the use and care of APC-7 connectors.

[2] Protect critical contacting surfaces by leaving the coupling sleeve extended when connectors are not in use.

Figure 3-1. Front Panel Features (Sheet 2 of 2)



1. **Power Line Module and Fuse.** Allows selection of 100, 120, 220 or 240 Vac Operation. To change power selection, power cable must be disconnected from rear of instrument. This allows plastic window covering fuse compartment to slide to one side, exposing fuse. To either change fuses or power selection, pull outward on lever in fuse compartment.

2. **FREQ REF INPUT.** Accepts a voltage proportional to reference channel input frequency (1 V/GHz). Voltage is used in AUTO mode operation. FREQ REF INPUT is supplied by the RF section of the 8620C Sweep Oscillator.

3. **SOURCE CONTROL.** For use when operated with the 8620C Sweep Oscillator. Connector is used with Source Control cable to provide interconnection of Stop Sweep and External Trigger between 8410B and 8620C Sweep Oscillator to allow multi-octave sweeps.

4. **SWP REF INPUT.** SWP REF INPUT is not used with the 8620A/C Sweep Oscillator. Accepts a voltage proportional to reference channel input frequency for single octave sweeps. Voltage enables auto-tuning to track fast sweeping input frequencies. Nominal 0 to +40 volts per octave from 20K ohms ±20% source impedance required. The lower voltage must coincide with the lowest input frequency. HP 690 and 8690 Sweep Oscillators furnish suitable reference voltages.

5. **TEST CHAN OUT.** 278 kHz sine wave. Amplitude depends upon the amplitude of the test channel RF input and the settings of the front-panel TEST CHANNEL GAIN (dB) and AMPL VERNIER controls. Amplitude range is 0 to about 10 volts p-p.

6. **REF CHAN OUT.** 278 kHz sine wave with amplitude fixed at about 2 volts p-p nominal when REF CHANNEL LEVEL meter reads in the OPERATE region.

7. **TEST PHASE.** 278 kHz sine wave with amplitude fixed at about 0.22 volts p-p. Signal is in phase with test channel input.

8. **BLANK.** Provides a −2 to −4 volt blanking signal when the 8410B is not phase locked. This blanking signal may be used with an auxiliary display unit.

9. **AIR INTAKE FILTER.** Clean regularly. Do not obstruct airflow.

10. **SERIAL NUMBER PLATE.** Eight digit serial number should be included in any correspondence concerning the Model 8410B.

[1] Swept frequency measurements can be made over somewhat wider frequency ranges than indicated by the FREQ RANGE (GHz) selector provided the sweep reference voltages cover the required ranges.

Figure 3-2. Model 8410B Rear Panel Features

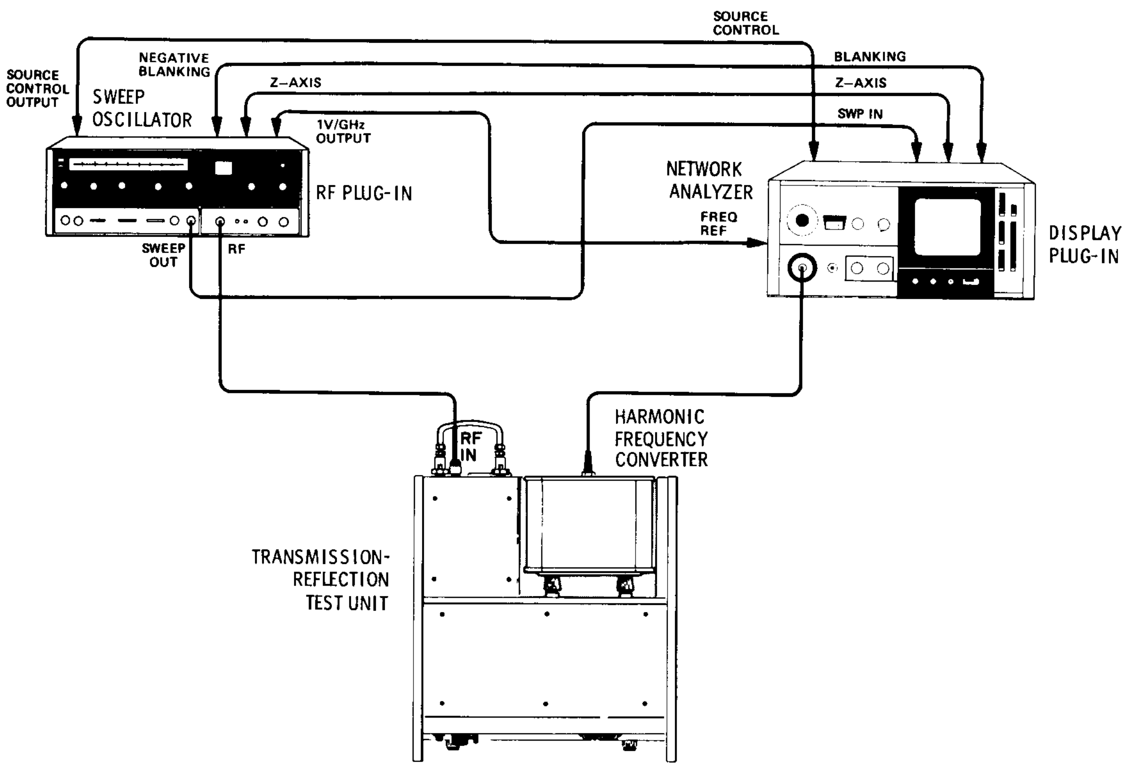


Figure 3-3. Typical Test Setup for Multioctave Measurements

SECTION IV
PERFORMANCE TESTS

4-1. INTRODUCTION

4-2. This section provides instructions for checking calibration and performance of the 8410B Network Analyzer and 8411A Harmonic Frequency Converter.

CAUTION

STATIC DISCHARGE. The sampling diodes in the 8411A may be damaged by a discharge of static electricity. Momentarily ground and short connectors prior to making connection to 8411A input connectors.

MAXIMUM RF POWER. Maximum RF input at 8411A before damage occurs is 50 mW. RF levels above −10 dBm in the test channel and −18 dBm in the reference channel will cause distortion in the 8411A preamplifiers.

MAGNETIC FIELDS. When using an 8412A or 8414A Display plug-in, do not place the 8410B near a sweep generator containing a BWO which has an unshielded permanent magnet or the CRT will be permanently magnetized, causing poor focus. Separate 8412A or 8414A from any magnetic source by a distance of at least two feet.

4-3. LINE VOLTAGE REQUIREMENTS.

4-4. During the performance test, the network analyzer must be connected to a source of power which is 50 to 60 Hz and 100, 120, 220, or 240 VAC +5−10%. If source power is not within tolerance, the network analyzer should be connected through a variable auto transformer to the ac power source. The line voltage at the input of the 8410B should then be adjusted to 115 or 230 Vac +5−10%.

4-5. PERFORMANCE TEST PROCEDURES

4-6. PURPOSE

4-7. The procedure in paragraphs 4-12 through 4-18 check the 8410B and 8411A performance. This procedure may be used during incoming inspection, periodic evaluation, or after repair or alignment. The tests can be performed without access to the instrument interior. The specifications of Table 1-1 are the calibration standards.

4-8. Table 4-1 is a performance test record. This may be used during the test to record the test values obtained. This provides a permanent record of the test values for use at a later time during performance testing or periodic evaluation.

4-9. If the 8410B/8411A system fails to meet any of the calibration tests, and a circuit malfunction is not suspected, proceed to the appropriate adjustment procedure in Section V. If a circuit malfunction is suspected, perform troubleshooting procedures in Section VIII.

4-10. TEST EQUIPMENT REQUIRED

4-11. The test instruments and accessories required to make the performance test are listed in Table 1-8. Test instruments other than the ones listed can be used, provided their performance equals or exceeds the Critical Specifications listed.

PERFORMANCE TESTS

4-12. AUTOMATIC TUNING TEST

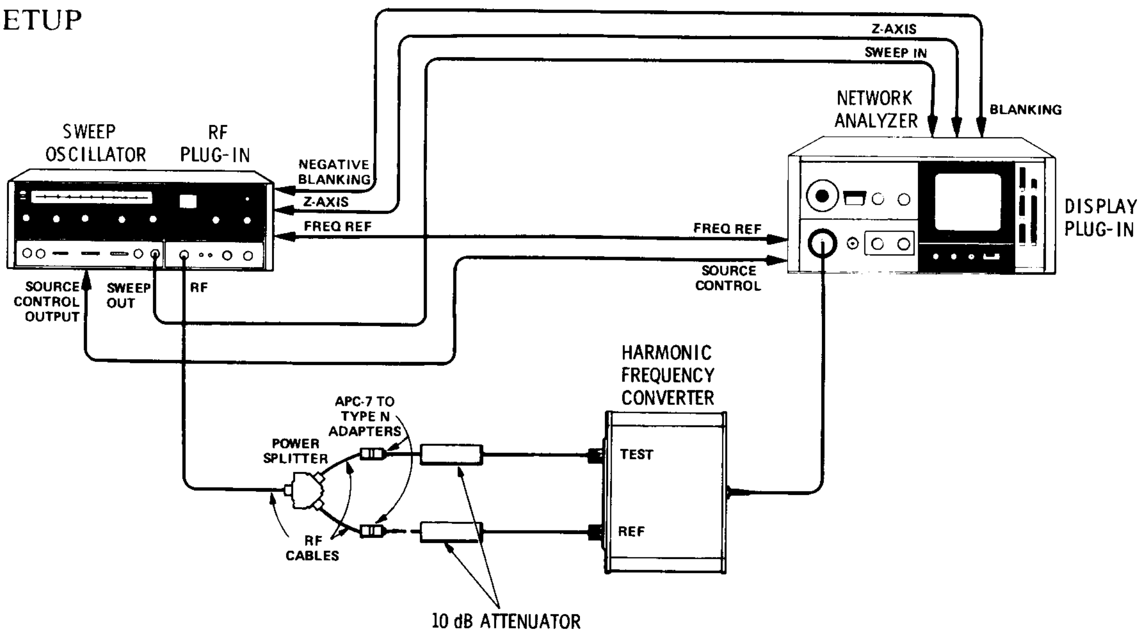
SPECIFICATION TESTED

Automatic Tuning

TEST DESCRIPTION

Sets up initial test conditions and checks for phase lock of the system.

TEST SETUP



TEST EQUIPMENT: Items 1, 10, 14, 16, 20, 23, 25, Table 1-8.

PROCEDURE

a. Connect equipment as shown in test setup above.

b. Check that line voltage at input of 8410B is 100, 120, 220, or 240 VAC +5% or −10%, and that the line-voltage selection card in the power module at the rear of the 8410B corresponds to the line voltage.

c. Set signal source for full band sweep operation, any frequency from 110 MHz to 12.4 GHz. (18 GHz if option 018). Set RF BLANKING to OFF. Set sweep speed to approximately the middle of the fast range. Use MARKER Sweep when using 86222A/B RF plug-in and set START MARKER to ⩾ 110 MHz.

d. Set 8410B FREQ RANGE switch to AUTO and TEST CHANNEL GAIN to 20 dB.

e. Adjust signal source POWER LEVEL control for an 8410B REF CHANNEL LEVEL meter indication in the OPERATE region.

f. Set 8412A Display MODE switch to AMPL, dB/DIV to 10, and BW to 10 kHz.

4-12. AUTOMATIC TUNING TEST (Cont'd)

g. Set 8410B SWEEP STABILITY control to a position that gives a continuous amplitude trace on 8412A display. A typical setting is at 1 o'clock position. It may be necessary to reduce sweep rate on signal source. (Bright dots on the display are band switch points for either the 8410B or the 8620C.) A typical phase-locked signal trace is shown in Figure 4-1. A signal that is not phase locked is shown in Figure 4-2.

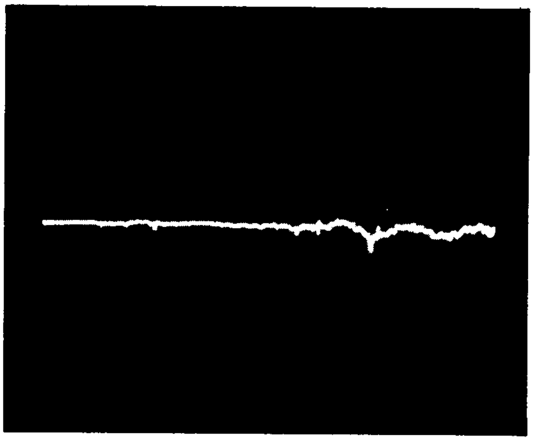


Figure 4-1. Typical Display of Phase-Locked Signal, 0.11 to 2 GHz, or 2 to 18 GHz

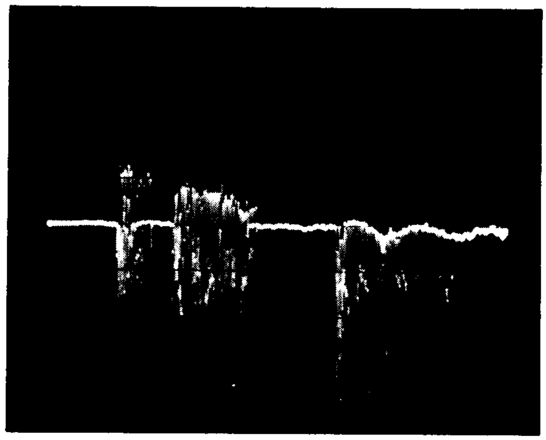


Figure 4-2. Typical Display of Signal That is Not Phase-Locked

4-13. REFERENCE CHANNEL INPUT POWER RANGE TEST

SPECIFICATION TESTED

REFERENCE CHANNEL INPUT POWER RANGE: Variation between −18 and −35 dBm, 0.11 to 12.4 GHz, and between −18 and −25 dBm, 12.4 to 18 GHz (Option 018), causes ≤ 1.5 dB amplitude and ≤ 4° phase change at output.

TEST DESCRIPTION

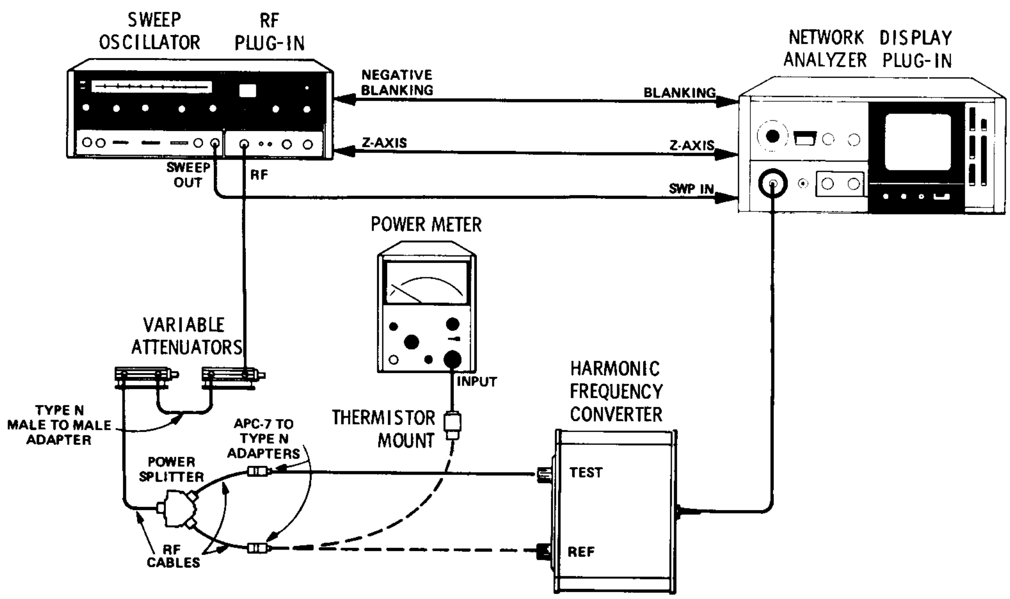
The AGC circuit is checked for correct operation between at least −18 dBm and −35 dBm range, 0.11 to 12.4 GHz, and between −18 and −25 dBm, 12.4 to 18 GHz (Option 018). This is done by changing RF input power levels to the two operating extremes of the AGC circuit and still maintaining constant reference channel output.

Phase and amplitude are then monitored through the specified AGC range to determine that they remain within specifications through the entire range.

PERFORMANCE TESTS

4-13. REFERENCE CHANNEL INPUT POWER RANGE TEST (Cont'd)

TEST SETUP



TEST EQUIPMENT: Items 1, 2, 10, 14, 20, 23, 24, 26, 27, 28, Table 1-8.

PROCEDURE

a. Change equipment test setup as above with 8411A REF port connected to cable from power splitter. Set signal source to CW mode and frequency to 2 GHz. Set 8410B SWEEP STABILITY control to CW detent position and FREQ RANGE control to include 2 GHz. Preset 1 dB step attenuator to 0 and 10 dB step attenuator to 10.

b. Check for phase-locked condition in the 8410B as follows:

(1) REF CHANNEL LEVEL meter should indicate in the OPERATE range. If not, adjust signal source POWER LEVEL control and 10 dB step attenuator to obtain OPERATE indication on meter.

(2) Set 8412A MODE Switch to PHASE and DEG/DIV Switch to 90. Adjust the PHASE VERNIER control. The dot on the CRT should be stable and move smoothly in a vertical direction. Return 8412A MODE switch to AMPL (Amplitude).

c. Set 8412A Display MODE to AMPL and dB/DIV to 1.0 dB. Set 8410B TEST CHANNEL GAIN to 20 dB and set CRT dot to center horizontal line with AMPLITUDE VERNIER. Increase power from signal source until 8412A indication starts to increase (>0.5 dB). This indicates that the upper limit of the AGC range is reached.

d. Disconnect 8411A REFERENCE Port from cable to power splitter and connect power meter thermistor mount to this cable. Power meter indication must be $\geqslant -18$ dBm. Note and record power meter indication.

PERFORMANCE TESTS

4-13. REFERENCE CHANNEL INPUT POWER RANGE TEST (Cont'd)

e. Set signal source to 12.4 GHz and set 8410B FREQ RANGE control to include 12.4 GHz. Set POWER LEVEL control of signal source for a power meter indication of − 18 dBm.

f. Disconnect power meter thermistor mount and reconnect 8411A REFERENCE port to the cable from the power splitter. Set CRT dot to center horizontal line with AMPLITUDE VERNIER control. Reduce RF input power by inserting attenuation with the variable attenuators until 8412A indication starts to decrease (>1 dB). This indicates that the lower limit of the AGC range is reached. The amount of attenuation inserted should be ⩾ 17 dB. This, when added to the − 18 dBm reference that was set in step "e" will give the lower AGC limit of ⩾ −35 dBm. With normal AGC action, the 8412A display indication should stay constant between at least the − 18 to − 35 dBm range. Note the limits of the AGC range.

g. Proceed to step "j" if 8411A does not contain option 018.

OPTION 018 ONLY (12.4 to 18 GHz Range)

h. Disconnect 8411A REFERENCE port from cable to power splitter and connect thermistor mount to this cable. Set signal source to 18 GHz and set 8410B FREQ RANGE control to include 18 GHz. Set POWER LEVEL control of signal source for a power meter indication of − 18 dBm.

i. Disconnect power meter thermistor mount and reconnect 8411A REFERENCE port to the cable from the power splitter. Set CRT dot to center horizontal line with AMPLITUDE VERNIER control. Reduce RF input power by inserting attenuation with the variable attenuators until 8412A indication starts to decrease (>1 dB). This indicates that the lower limit of the AGC range is reached. The amount of attenuation inserted should be ≥7 dB. This, when added to the − 18 dBm reference that was set in step "h" will give the lower AGC limit of ≤ −25 dBm. With normal AGC action, the 8412A display indication should stay constant between at least the − 18 to − 25 dBm range. Note the limits of the AGC range.

j. Set signal source to 12.4 GHz and set 8410B FREQ RANGE control to include 12.4 GHz. Disconnect 8411A REFERENCE port from cable to power splitter and connect power meter thermistor mount to this cable. Set output level of signal source for a − 18 dBm indication on power meter. Disconnect power meter thermistor mount and reconnect the 8411A REFERENCE port to the cable from the power splitter.

k. Set 8412A Display MODE switch to DUAL, dB/DIV to 1.0, DEG/DIV to 1.0 and BW to 0.1 KHz. With 8410B AMPLITUDE VERNIER control, position amplitude trace dot on center horizontal line and with PHASE VERNIER control, position phase trace dot one major line below the center horizontal line on CRT.

l. While observing the 8412A Display, increase the variable attenuator by 17 dB. This is the specified AGC range of − 18 to − 35 dBm. The difference between the maximum and minimum amplitude and phase indications should not be greater than 1.5 dB or 4 degrees over the 17 dB range.

OPTION 018 ONLY (12.4 to 18 GHz Range)

m. Set signal source to 18 GHz and set 8410B FREQ RANGE control to include 18 GHz. Disconnect 8411A REFERENCE port from cable to power splitter and connect power meter thermistor mount to this cable. Set POWER LEVEL control of signal source for a − 18 dBm indication on power meter. Disconnect power meter thermistor mount and reconnect the 8411A REFERENCE port to the cable from the power splitter.

PERFORMANCE TESTS

4-13. REFERENCE CHANNEL INPUT POWER RANGE TEST (Cont'd)

n. Set 8412A Display MODE switch to DUAL, dB/DIV to 1.0, DEG/DIV to 1.0, and BW to 0.1 KHz. With 8410B AMPLITUDE VERNIER control, position amplitude trace dot on center horizontal line and with PHASE VERNIER control, position phase trace dot one major line below the center horizontal line on CRT.

o. While observing the 8412A Display, increase the variable attenuator by 7 dB. This is the specified AGC range of −18 to −25 dBm. The difference between the maximum and minimum amplitude and phase indications should not be greater than 1.5 dB or 4 degrees over the 7 dB range.

4-14. AMPLITUDE RANGE AND ACCURACY TEST

SPECIFICATION TESTED

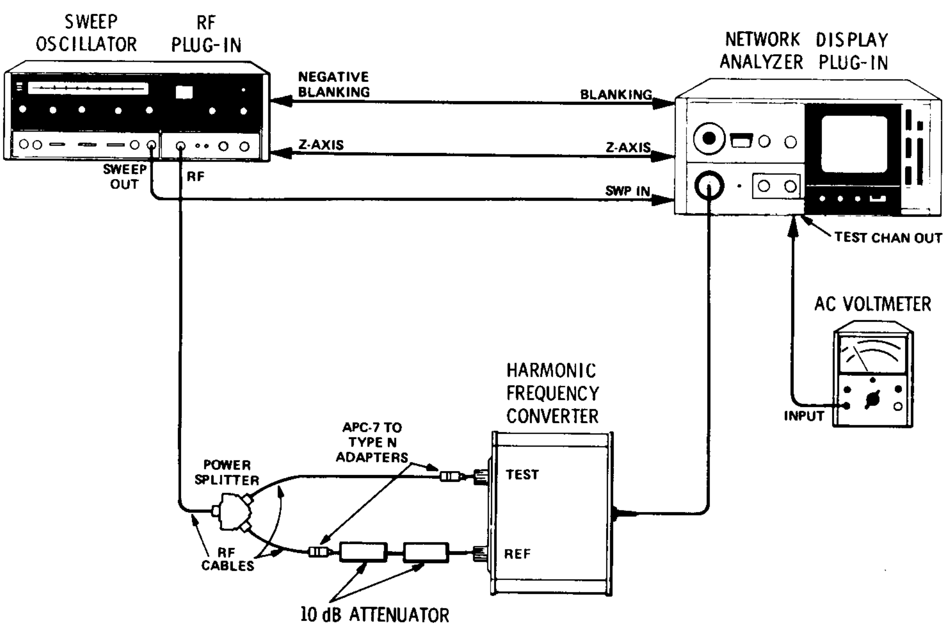
AMPLITUDE RANGE: 69 dB total in 10- and 1-dB steps; vernier provides continuous adjustment over at least 2 dB.

AMPLITUDE ACCURACY: ±0.1 dB per 10-dB step, not to exceed ±0.2 dB cumulative; ±0.05 dB per 1-dB step, not to exceed ±0.1 dB cumulative.

TEST DESCRIPTION

The TEST CHANNEL GAIN attenuators are tested for accuracy and the AMPL VERNIER control operation is checked. This is done by feeding a constant RF signal through the test channel and monitoring the 278-kHz signal on an ac voltmeter. The attenuators are set at each position and the resultant change in signal level is read on the ac voltmeter.

TEST SETUP



TEST EQUIPMENT: Items 1, 3, 10, 14, 16, 20, 23, Table 1-8

4.14. AMPLITUDE RANGE AND ACCURACY TEST (Cont'd)

PROCEDURE

a. Change equipment test setup as shown above. Set signal source to CW mode and frequency to any CW frequency in 0.11 to 12.4 GHz range (18 GHz if option 018). Set 8410B SWEEP STABILITY control to CW detent position and FREQ RANGE control to include frequency of signal source.

b. Check for phase-locked condition in the 8410B as follows:

(1) REF CHANNEL LEVEL meter should indicate in the OPERATE range. If not, adjust signal source POWER LEVEL control to obtain an OPERATE indication on meter.

(2) Set 8412 MODE Switch to PHASE and DEG/DIV Switch to 90. Adjust the PHASE VERNIER control. The dot on the CRT should be stable and move smoothly in a vertical direction.

c. Set 8410B TEST CHANNEL GAIN 10 dB/step control to 0 dB.

d. Set ac voltmeter to −50 dB range and adjust 8410B AMPLITUDE VERNIER control and TEST CHANNEL GAIN 1 dB/step control for zero dB indication on −50 dB range of ac voltmeter.

e. Increase Model 8410B TEST CHANNEL GAIN in 10-dB steps and check accuracy as indicated below.

Model 8410B TEST CHANNEL GAIN Tens Control Setting	AC Voltmeter Range Setting	AC Voltmeter Indication
10 dB	−40 dB	0 (±0.1) dB ± voltmeter error
20 dB	−30 dB	0 (±0.2) dB ± voltmeter error
30 dB	−20 dB	0 (±0.2) dB ± voltmeter error
40 dB	−10 dB	0 (±0.2) dB ± voltmeter error
50 dB	0 dB	0 (±0.2) dB ± voltmeter error
60 dB	+10 dB	0 (±0.2) dB ± voltmeter error

f. Set ac voltmeter to −30 dB range, set 8410B TEST CHANNEL GAIN 10 dB/step control to 20 dB, and set 1 dB/step control to zero dB. Adjust AMPL VERNIER control for a scale reference on AC Voltmeter at zero or any one-dB scale division.

g. Increase 8410B TEST CHANNEL GAIN 1 dB/step control in 1-dB steps; ac voltmeter indications should increase in corresponding 1-dB steps. If necessary, change ac voltmeter range to a higher or lower scale. Each meter indication must be within ±0.1 dB of a 1-dB major scale division on the meter, ± the tolerance of the voltmeter.

h. Using the ac voltmeter, check AMPL VERNIER range. It should be at least 2 dB.

PERFORMANCE TESTS

4-15. TEST CHANNEL NOISE TEST

SPECIFICATION TESTED

TEST CHANNEL NOISE: < −75 dBm, 0.11 to 12.4 GHz;
< −68 dBm, 12.4 to 18 GHz (OPTION 018)

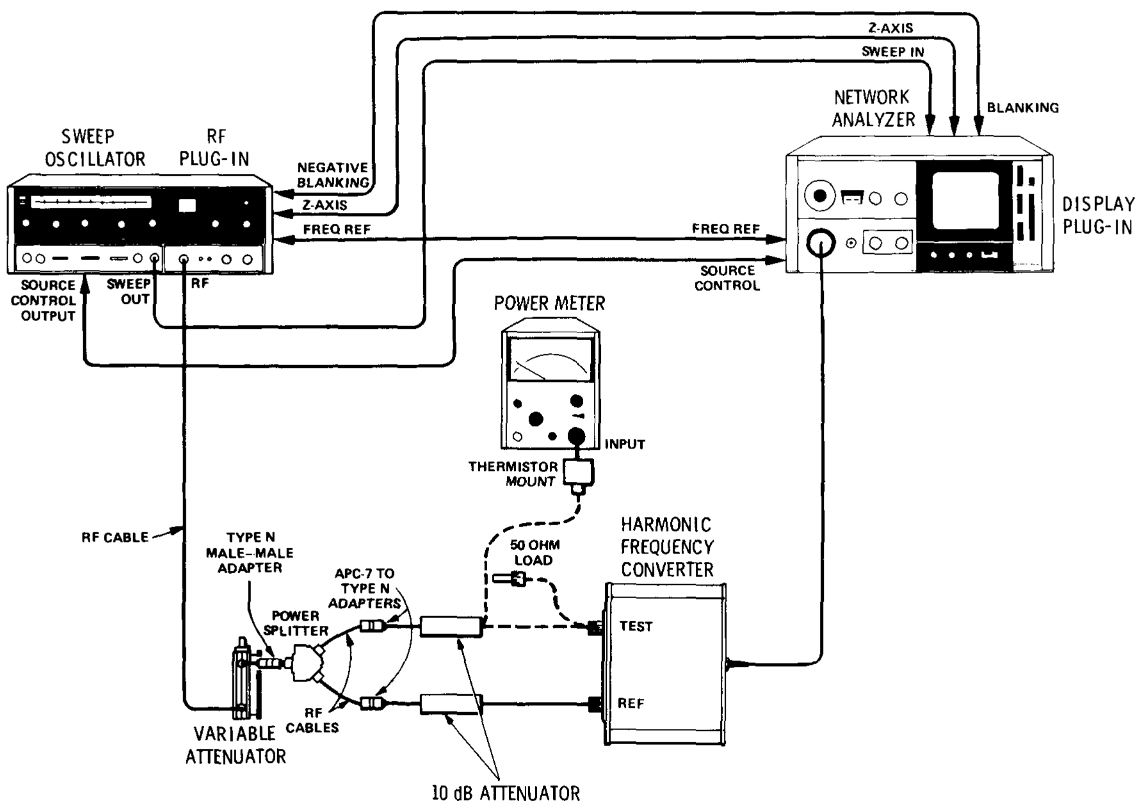
TEST DESCRIPTION

A −30 dBm signal at the TEST input of the 8411A is used to set a reference at the Display Plug-in. The RF input signal is removed from the 8411A TEST input and the TEST input is terminated, leaving only TEST CHANNEL noise to be measured at the display plug-in. Noise level of −75 dBm is 45 dB lower than the −30 dBm reference level. 40 dB of gain is added in the TEST CHANNEL GAIN control and −5 dB from zero reference is indicated on the 8412A Display plug-in totaling 45 dB.

FOR OPTION 018 ONLY (12.4 to 18 GHz RANGE)

A −25 dBm signal at the TEST input of the 8411A is used to set a reference at the Display Plug-in. The RF input signal is removed from the 8411A TEST input and the TEST input is terminated, leaving only TEST CHANNEL noise to be measured at the display plug-in. Noise level of −68 dBm is 43 dB lower than the −25 dBm reference level. 40 dB of gain is added in the TEST CHANNEL GAIN control and −3 dB from zero reference is indicated on the 8412A Display plug-in totaling 43 dB.

TEST SETUP



TEST EQUIPMENT: Items 1, 2, 10, 14, 16, 18, 20, 23, 25, 27, 28, Table 1-8.

PERFORMANCE TESTS

4-15. TEST CHANNEL NOISE TEST (Cont'd)

PROCEDURE

a. Change equipment test setup as shown above with Power meter thermistor mount connected to 10 dB attenuator from power splitter. Set signal source to CW Mode and frequency to 12.4 GHz.

b. Adjust 10 dB step attenuator and POWER LEVEL control of Sweep Oscillator for a −30 dBm indication on power meter. Disconnect thermistor mount and connect 8411A TEST port to 10 dB attenuator from power splitter.

c. Set 8410B SWEEP STABILITY control to CW detent position and FREQ RANGE control to include 12.4 GHz. Check that REF CHANNEL LEVEL meter indicates in the OPERATE range.

d. Check for phase-locked condition in the 8410B as follows:
Set 8412A MODE Switch to PHASE and DEG/DIV Switch to 90. Adjust the PHASE VERNIER control. The dot on the CRT should be stable and move smoothly in a vertical direction.

e. Set 8410B TEST CHANNEL GAIN controls to 20 dB.

f. Set 8412A Display MODE switch to AMPL, dB/DIV to 10, and BW to 0.1 KHz. Adjust 8410B AMPLITUDE VERNIER and TEST CHANNEL GAIN 1 dB/step controls to position CRT dot on center horizontal line of 8412 display.

g. Disconnect 10-dB attenuator from 8411A TEST channel input and connect 50-ohm termination to 8411A TEST input.

h. Increase 8410B TEST CHANNEL GAIN control by 40 dB. The 8412A should indicate in the negative direction at least −5 dB. (This indicates less than −75 dBm equivalent input noise.)

OPTION 018 ONLY (12.4 to 18 GHz RANGE)

i. Change CW frequency of signal source to 18 GHz.

j. Disconnect 10 dB attenuator from 8411A TEST port and check for −25 dBm signal level at 10 dB attenuator. If necessary, adjust Sweep Oscillator POWER LEVEL control for −25 dBm indication on power meter. Reconnect 10 dB attenuator to 8411A TEST port.

k. Set 8410B SWEEP STABILITY control to CW detent position and FREQ RANGE control to include 18 GHz.

l. Check for phase-locked condition in the 8410B as follows:
(1) Set 8412A MODE Switch to PHASE and DEG/DIV Switch to 90. Adjust the PHASE VERNIER control. The dot on the CRT should be stable and move smoothly in a vertical direction.

m. Set 8410B TEST CHANNEL GAIN controls to 20 dB.

PERFORMANCE TESTS

4-15. TEST CHANNEL NOISE TEST (Cont'd)

n. Set 8412A Display MODE switch to AMPL, dB/DIV to 10, and BW to 0.1 kHz. Adjust 8410B AMPLITUDE VERNIER and TEST CHANNEL GAIN 1 dB/step controls to position CRT dot on center horizontal line of 8412A display.

o. Disconnect 10 dB attenuator from 8411A TEST channel input and connect 50-ohm termination to 8411A TEST input.

p. Increase 8410B TEST CHANNEL GAIN control by 40 dB. The 8412A should indicate in the negative direction at least −3 dB. (This indicates less than −68 dBm equivalent input noise.)

4-16. TEST CHANNEL DYNAMIC RANGE TEST

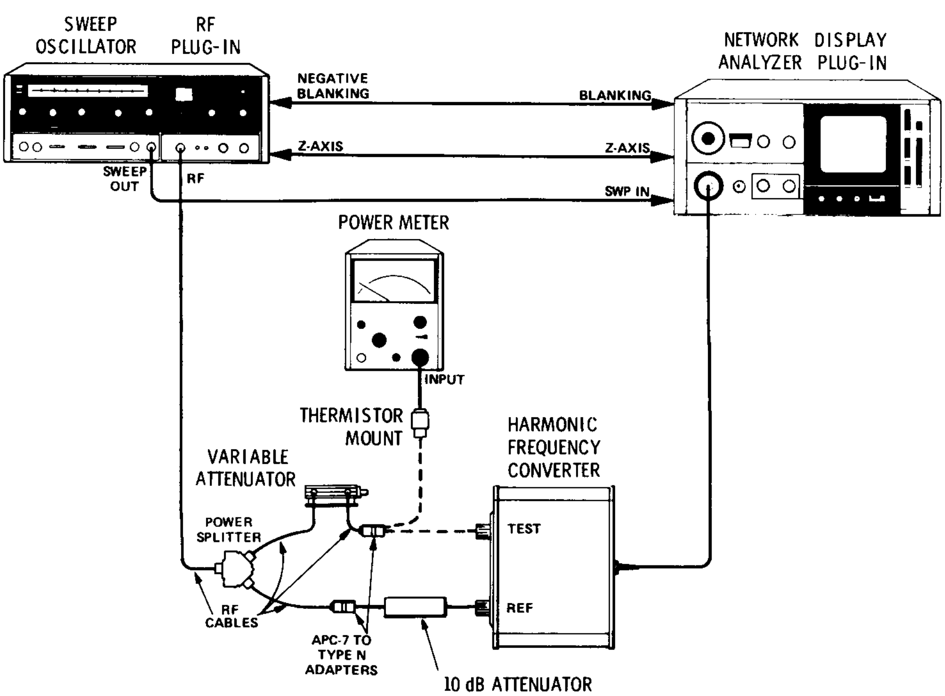
SPECIFICATION TESTED

TEST CHANNEL DYNAMIC RANGE: −10 to −75 dBm, 0.11 to 12.4 GHz;
−10 to −68 dBm, 12.4 to 18 GHz (Option 018).

TEST DESCRIPTION

A known signal level of −10 dBm is applied to the 8411A TEST channel RF input. A reference is established on the 8412A. This represents the top of the test channel input power range. A variable attenuator is used to reduce the RF signal at the TEST channel input of the 8411A to > −75 dBm (−68 dBm, 12.4 to 18 GHz for Option 018). The equivalent TEST CHANNEL GAIN is added and the resulting display is compared to the original reference.

TEST SETUP



TEST EQUIPMENT: Items 1, 2, 10, 14, 16, 20, 23, 24, 27, Table 1-8.

4-16. TEST CHANNEL DYNAMIC RANGE TEST (Cont'd)

PROCEDURE

a. Change equipment test setup as shown above with 8411A TEST port connected to cable from variable attenuator.

b. Set signal source to CW mode and Frequency to 12.4 GHz. Set 8410B SWEEP STABILITY control to CW detent position and FREQ RANGE switch to include 12.4 GHz.

c. Check for phase-locked condition in the 8410B as follows:

(1) REF CHANNEL LEVEL meter should indicate in the OPERATE range. If not, adjust signal source POWER LEVEL control to obtain OPERATE indication on meter.

(2) Set 8412A MODE Switch to PHASE and DEG/DIV Switch to 90. Adjust the PHASE VERNIER control. The dot on the CRT should be stable and move smoothly in a vertical direction. Return 8412A MODE Switch to AMPL (Amplitude).

d. Disconnect 8411A TEST port from cable to variable attenuator and connect power meter thermistor mount to this cable.

e. Set variable attenuator and 8410B TEST CHANNEL GAIN controls to zero dB.

f. Adjust signal source POWER LEVEL control for – 10 dBm indication on power meter. Signal source output power should not be adjusted again during the remainder of the test. Disconnect thermistor mount from cable to variable attenuator and reconnect cable to 8411A TEST port.

g. Set 8412A MODE Switch to AMPL, BW to 0.1 kHz, and dB/DIV to 10. Adjust 8410B AMPLITUDE VERNIER and TEST CHANNEL GAIN 1 dB/step controls to place dot on CRT one major division below center horizontal graticule line.

h. Set variable attenuator to 70 dB and increase 8410B TEST CHANNEL GAIN by 65 dB. The dot on the CRT should be below the reference established in step "g".

OPTION 018 ONLY (12.4 to 18 GHz RANGE)

i. Set signal source to CW mode and Frequency to 18 GHz. Set 8410B SWEEP STABILITY control to CW detent position and FREQ RANGE Switch to include 18 GHz.

j. Set variable attenuator and 8410B TEST CHANNEL GAIN controls to zero dB.

4-16. TEST CHANNEL DYNAMIC RANGE TEST (Cont'd)

k. Check for phase-locked condition in the 8410B as follows:

(1) REF CHANNEL LEVEL meter should indicate in the OPERATE range. If not, adjust signal source power output to obtain an OPERATE indication on meter.

(2) Set 8412A MODE Switch to PHASE and DEG/DIV Switch to 90. Adjust the PHASE VERNIER control. The dot on the CRT should be stable and move smoothly in a vertical direction. Return 8412A MODE Switch to AMPL (Amplitude).

l. Disconnect 8411A TEST port from cable to variable attenuator and connect power meter thermistor mount to this cable.

m. Adjust signal source POWER LEVEL control for − 10 dBm indication on power meter. Signal source POWER LEVEL control should not be adjusted again during the remainder of the test. Disconnect thermistor mount from cable to variable attenuator and reconnect cable to 8411A TEST port.

n. Set 8412A MODE Switch to AMPL, BW to 0.1 KHz, dB/DIV to 10. Adjust 8410B AMPLITUDE VERNIER and TEST CHANNEL GAIN 1 dB/step controls to place dot on CRT one major division below center horizontal graticule line.

o. Set variable attenuator to 60 dB and increase 8410B TEST CHANNEL GAIN by 58 dB. The dot on the CRT should be below the reference established in step "n".

4-17. CHANNEL ISOLATION TEST

SPECIFICATION TESTED

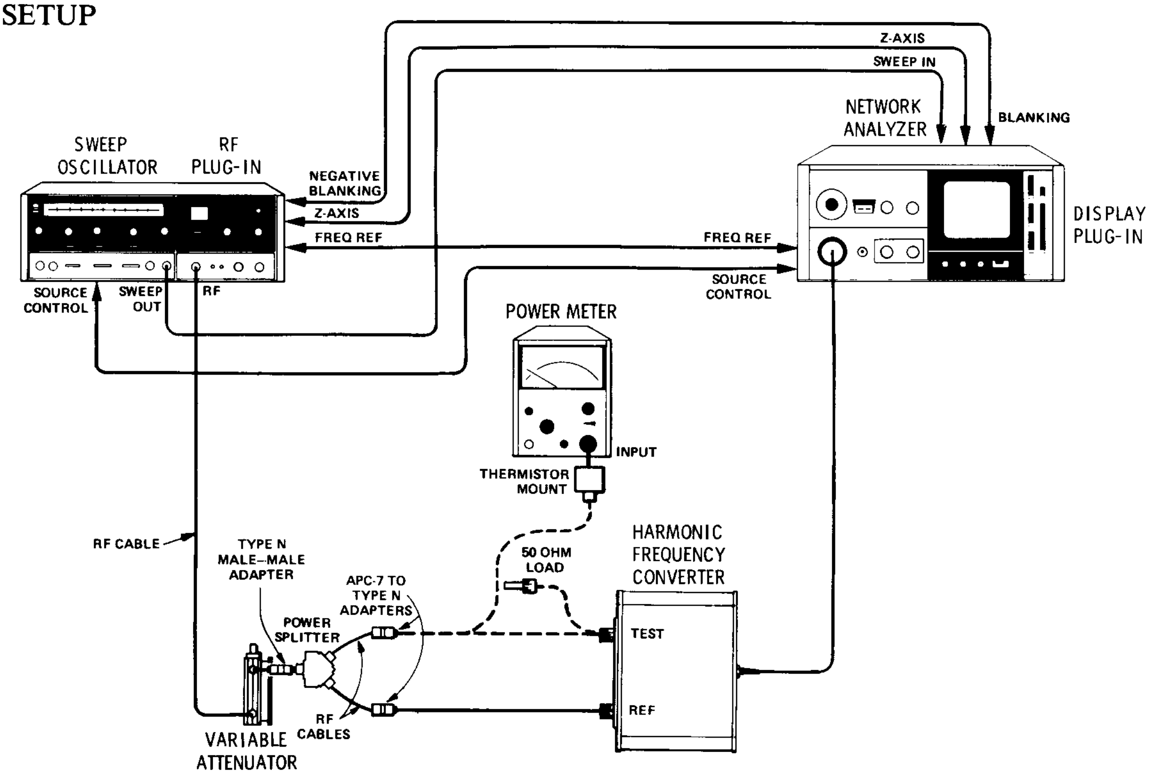
CHANNEL ISOLATION: >65 dB, 0.11 to 6.0 GHz; >60 dB, 6.0 to 12.4 GHz; >50 dB, 12.4 to 18 GHz (Option 018).

TEST DESCRIPTION

A reference is established on the 8412A Display. The RF signal to the 8411A test channel is disconnected and the input is terminated with a 50-ohm load. With the RF signal applied only to the reference channel, any signal present in the test channel is due to signal leakage between channels. Isolation between channels is measured by observing the signal level below the reference level established on the 8412A Display.

4-17. CHANNEL ISOLATION TEST (Cont'd)

TEST SETUP



EQUIPMENT: Items 1, 2, 10, 14, 18, 20, 23, 25, 27, 28, Table 1-8.

PROCEDURE

a. Change equipment test setup as shown above with the power meter thermistor mount connected to the cable from the power splitter.

b. Set signal source for manual sweep in the 2.0 to 6.0 GHz range and set POWER LEVEL control for −18 dBm indication on power meter. Set MANUAL sweep control to full counterclockwise position.

c. Disconnect thermistor mount from cable and connect cable to 8411A TEST port.

d. Set 8410B FREQ Range to AUTO and SWEEP STABILITY to CW detent position. Set TEST CHANNEL GAIN control to 20 dB.

e. Check for phase-locked condition in the 8410B as follows:
   (1) REF CHANNEL LEVEL meter should indicate at the right edge of the OPERATE range.

   (2) Set 8412A MODE Switch to PHASE and DEG/DIV Switch to 90. Adjust the PHASE VERNIER control. The dot on the CRT should be stable and move smoothly in a vertical direction.

4-17. CHANNEL ISOLATION TEST (Cont'd)

f. Set 8412A MODE to AMPL, dB/DIV to 10, and BW to 0.1 KHz positions.

g. Use TEST CHANNEL GAIN and AMPLITUDE VERNIER controls to place CRT dot on top horizontal graticule line. This is the reference line and will be used for the remainder of the test.

h. Disconnect RF cable to 8411A TEST port and connect a 50-Ohm termination to TEST port.

i. Connect thermistor mount to RF cable from power splitter.

j. Manually sweep the signal source from 2 to 6 GHz while maintaining a −18 dBm indication on the power meter. The signal on the 8412A Display should be ≥65 dB below the reference level set in step "g".

k. Set signal source for manual sweep in the 6 to 12.4 GHz range. Manually sweep the signal source from 6 to 12.4 GHz while maintaining a −18 dBm indication on the power meter. The signal on the 8412A Display should be ≥60 dB below the reference level set in step "g".

OPTION 018 ONLY (12.4 to 18 GHz RANGE)

l. Set signal source for manual sweep in the 12.4 to 18 GHz range. Manually sweep the signal source from 12.4 to 18 GHz while maintaining a −18 dBm indication on the power meter. The signal on the 8412A Display should be ≥50 dB below the reference level set in step "g".

4-18. INPUT IMPEDANCE TEST

SPECIFICATION TESTED

INPUT IMPEDANCE: 50 Ohms

Frequency Range	SWR	RETURN LOSS
0.11 to 2 GHz	<1.5	>14 dB
2 to 6 GHz	<2.0	>9.6 dB
6 to 12.4 GHz	<3.0	>6 dB
12.4 to 18 GHz (Option 018)	<3.0	>6 dB

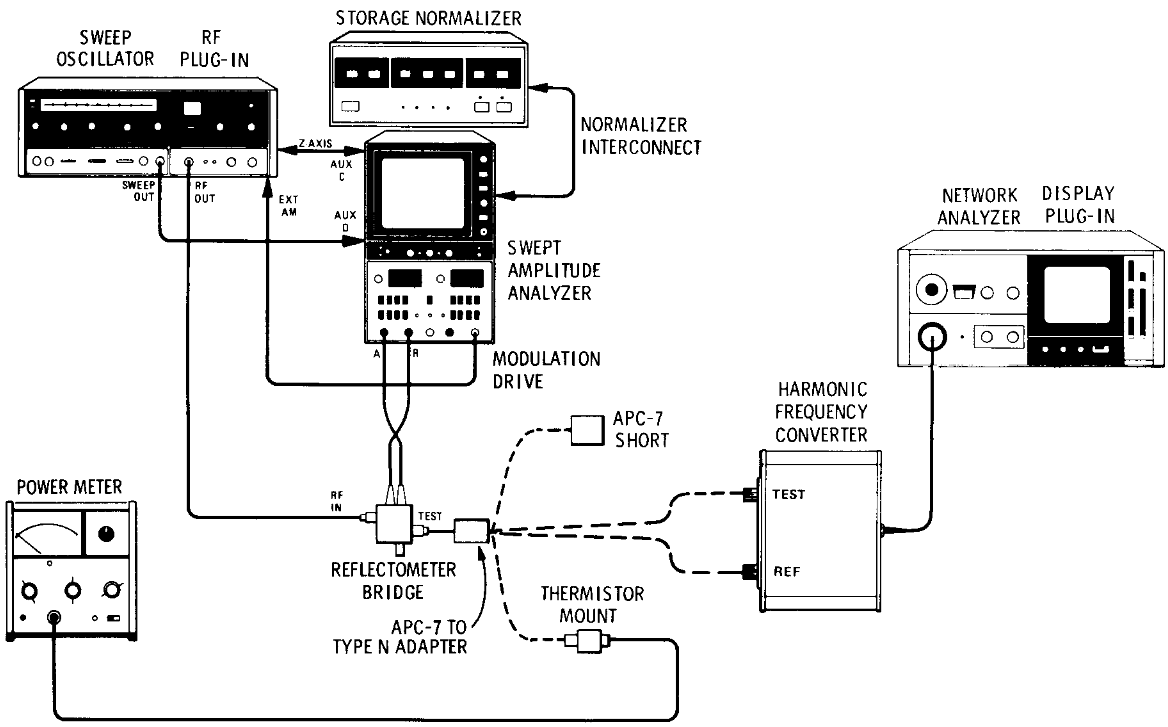
TEST DESCRIPTION

The input impedance of the REFERENCE and TEST input ports on the 8411A is tested by measuring the reflected RF signal from the ports, using a Swept Amplitude Analyzer with a Reflectometer Bridge. Connecting an APC-7 short to the TEST port of the Reflectometer Bridge provides a reference on the Analyzer. The short completely reflects the RF signal back to the measurement bridge. The REFERENCE and TEST ports of the 8411A are connected and the amplitude of the reflection is compared to the reference on the swept amplitude analyzer.

PERFORMANCE TESTS

4-18. INPUT IMPEDANCE TEST (Cont'd)

TEST SETUP



TEST EQUIPMENT: Items 1, 2, 7, 19 21, Table 1-8.

PROCEDURE

a. Change equipment test setup as shown above using the 0.11 to 2.0 GHz RF plug-in with no connections made to the TEST port of the reflectometer bridge. Match 8750A Storage-Normalizer to 8755B. Refer to Secm III of 8750A Operating and Service Manual (HP Part Number 08750-90016).

b. Set 8755B Channel 1 DISPLAY mode to REFERENCE POSITION and adjust CRT trace to center horizontal graticule line with 8750A in BYPASS mode.

c. Set 8755B Channel 1 DISPLAY to A/R, dB/DIV to 5, REFERENCE LEVEL to zero, REFERENCE LEVEL VERNIER to ON, and adjust VERNIER for a CRT trace on center horizontal graticule line.

0.11 TO 2 GHz FREQUENCY RANGE

d. Set signal source to sweep from 0.11 to 2 GHz.

e. Connect power meter thermistor mount to adapter on TEST port of reflectometer bridge and set signal source RF output level for a − 13 dBm indication on power meter.

f. Remove thermistor mount and connect APC-7 short to TEST port of bridge.

PERFORMANCE TESTS

4-18. INPUT IMPEDANCE TEST (Cont'd)

g. On 8750A, press CH 1, then INPUT, then STORE INPUT, then INPUT-MEM. This establishes reference on CRT display. If an 8750A is not available, draw the reference line on the CRT display with a grease pencil and take the difference between this line and the resulting trace in step "h" to determine return loss.

h. Remove APC-7 short and connect 8411A TEST port and then REFERENCE port to TEST port of reflectometer bridge.

i. The difference between the resulting CRT display and the reference established in step "g" should be >14 dB (with a ±.8 dB uncertainty).

2 TO 6 GHz FREQUENCY RANGE

j. Set signal source to sweep from 2 to 6 GHz and repeat steps "e" through "h".

k. The difference between the resulting CRT display and the reference established in step "g" should be >9.6 dB (with a ±0.7 dB uncertainty).

6 TO 12.4 GHz FREQUENCY RANGE

l. Set signal source to sweep from 6 to 12.4 GHz and repeat steps "e" through "h".

m. The difference between the resulting CRT display and the reference established in step "g" should be >6 dB (with a ±1.0 dB uncertainty).

12.4 TO 18 GHz FREQUENCY RANGE (OPTION 018)

n. Set signal source to sweep from 12.4 to 18 GHz and repeat steps "e" through "h".

o. The difference between the resulting CRT display and the reference established in step "g" should be >6 dB (with a ±1.1 dB uncertainty).

Table 4-1. Performance Test Record (Sheet 1 of 2)

PARA. NO.	PROCEDURE	INDICATION MIN.	ACTUAL	MAX.
4-12	Power line voltage input	90 Vac or 108 Vac or 198 Vac or 216 Vac	______ ______ ______ ______	105 Vac or 126 Vac or 231 Vac or 252 Vac
	Automatic tuning	Phase-lock	______	
4-13	Variation in reference channel of −18 to −35 dBm, 0.11 to 12.4 GHz and −18 to −25 dBm, 12.4 to 18 GHz (Option 018) produces constant output		______	Amplitude: min & max. 1.5 dB apart
			______	Phase: Min. & Max. 4° apart
4-14	TEST CHANNEL GAIN 10 dB/step			
	Attenuators at setting: 10 dB		______	0(±0.1) dB
	20 dB		______	0(±0.2) dB
	30 dB		______	0(±0.2) dB
	40 dB		______	0(±0.2) dB
	50 dB		______	0(±0.2) dB
	60 dB		______	0(±0.2) dB ± volt-meter error
	TEST CHANNEL GAIN 1 dB/step			
	Attenuators at setting: 1 dB		______	±0.1 dB of a 1-dB major scale division on meter, ± voltmeter error.
	2 dB		______	
	3 dB		______	
	4 dB		______	
	5 dB		______	
	6 dB		______	
	7 dB		______	
	8 dB		______	
	9 dB		______	
	AMPL VERNIER range	2 dB	______	
4-15	Test channel noise < −75 dBm, 0.11 to 12.4 GHz < −68 dBm, 12.4 to 18 GHz (Option 018)	 −75 dBm −68 dBm	 ______ ______	

Table 4-1. Performance Test Record (Sheet 2 of 2)

PARA. NO.	PROCEDURE	INDICATION MIN.	INDICATION ACTUAL	INDICATION MAX.
4-16	Test channel operates over −10 to −75 dBm 0.11 to 12.4 GHz −10 to −68 dBm 12.4 to 18 GHz (Option 018)	−75 dB −68 dBm	______ ______	
4-17	Channel isolation >65 dB in 0.11 to 6.0 GHz range, >60 dB in 6.0 to 12.4 GHz range, and >50 dB in 12.4 to 18 GHz range (Option 018)	65 dB (.11 to 6 GHz) 60 dB (6 to 12.4 GHz) 50 dB (12.4to18 GHz Option 018)	______ ______ ______	
4-18	SWR of 8411A REFERENCE and TEST ports, <1.5 in 0.11 to 2 GHz range, <2.0 in 2 to 6 GHz range, <3.0 in 6 to 12.4 GHz range, and < 3.0 in 12.4 to 18 GHz range (Option 018). (Indication in return loss.)		REFERENCE PORT	
			______	−14 dB (0.11 to 2.0 GHz)
			______	−9.6 dB (2 to 6 GHz)
			______	−6 dB (6 to 12.4 GHz)
			______	−6 dB (12.4 to 18 GHz Option 018)
			TEST PORT	
			______	−14 dB (0.11 to 2.0 GHz)
			______	−9.6 dB (2 to 6 GHz)
			______	−6 dB (6 to 12.4 GHz)
			______	−6 dB (12.4 to 18 GHz Option 018)

SECTION V
ADJUSTMENTS

5-1. INTRODUCTION

5-2. The procedures in this section provide adjustment instructions for the 8410B and 8411A. The adjustment procedure should not be performed as a routine maintenance procedure, but should only be used (1) after replacement of a part or component, (2) when the performance tests show that the specifications of Table 1-1 cannot be met, or (3) when instructed to do so in the troubleshooting procedure. Before attempting any adjustment, allow 30 minutes warm-up time for the 8410B and 8411A.

5-3. The procedure consists of adjusting variable controls or selecting the value of specific components. A list of controls and their functions is presented in Table 5-1. Table 5-2 is a list of factory-selected components. The procedure for selecting the correct values of each factory-selected component is referenced in the table. Table 5-3 gives HP Part Numbers for range of Factory Selected Components.

WARNING

Any service or adjustment performed with the covers removed should only be performed by qualified service personnel. A shock hazard exists with the covers removed.

5-4. TEST EQUIPMENT REQUIRED.

5-5. Test equipment required for each adjustment procedure is referenced at the bottom of the test setup and is listed in the Equipment List, Table 1-8. Test instruments other than the ones listed can be used, provided their performance equals or exceeds the Critical Specifications listed.

5-6. REPLACING FACTORY-SELECTED COMPONENTS.

5-7. The values of some components in the 8410B and 8411A are selected at the factory to provide particular electrical requirements. A list of Factory-Selected components is presented in Table 5-2. This table describes the function affected by the component, the range of values used, and the adjustment procedure for selecting the correct value. The recommended procedure for replacing a Factory-Selected part is as follows:

a. Try original value, then perform calibration test for that circuit.

b. If calibration test cannot be passed, try typical value listed in Table of Replaceable Parts, Table 6-3 or 6-4.

c. If calibration test still cannot be passed, perform adjustment procedure for that circuit using component values in the range given in Table 5-2, "RANGE OF VALUES" column.

Table 5-1. Alignment Controls

Reference Designator	Function Affected	Component Location Figure	Adjustment Procedure Paragraph
	8410B		
A7R10	DC voltage from A7 to control VTO frequency, CW operation	8-56	5-15
A9R9	VTO Trigger Threshold	8-63	5-17
A9R17	Sweep Delay	8-63	5-17
A10A1R9	+20 Vdc	8-59	5-8
A10A1R22	−20 Vdc and −11 Vdc	8-59	5-8
A12L2	Phase change with change in input power	8-35	5-14
A13C7	Frequency of second IF	8-41	5-11
A14L2	Phase change with change in input power	8-35	5-14
A18R2	Auto frequency range selection	8-65	5-18
	8411A		
A4R3	Reference channel sampler bias balance and channel isolation	8-29	5-20
A4R5	Reference channel sampler bias, and channel tracking	8-29	5-20
A5C13	Channel isolation	8-29	5-22
A5R3	Test channel sampler bias balance and channel isolation	8-29	5-22
A5R5	Test channel sampler bias and channel tracking	8-29	5-20
A5R20	Test channel preamplifier gain	8-29	5-23
A5R21	Channel phase balance	8-29	5-23
A6R2	Phase lock loop gain	8-32	5-19 & 5-21
A6R6	Phase lock loop gain	8-32	5-21
A6R7	Phase lock loop gain	8-32	5-21
A6R8	Phase lock loop gain	8-32	5-21
A6R14	Power amplifier bias	8-32	5-20
A6R16	VTO upper frequency limit	8-32	5-19
A7R5	65 MHz adjust	8-32	5-19
A7R19	Low Frequency clamp adjust	8-32	5-19

Table 5-2. Factory Selected Components

Reference Designator	Function Affected	Range of Values	Component Location Figure	Adjustment Procedure Paragraph
8410B				
A5R3	Phase detector A static output level	8.25K - 23.7K	8-53	5-9
A5R6	Phase detector B static output level	8.25K - 23.7K	8-53	5-9
A6C6	20.278 MHz Oscillator frequency	12-39 pf	8-53	5-11
A8R2	Triggering point of positive Schmitt trigger	68 - 100Ω	8-56	5-10
A8R39	Triggering point of negative Schmitt trigger	82 - 121Ω	8-56	5-10
A11C1	Phase relation of output signals	100 - 270 pF	8-47	5-16
A11C5	Test channel 278 kHz bandpass filter tuning	0 - 75 pF	8-47	5-16
A11C7	Phase relation of output signals	240 - 534 pF	8-47	5-16
A11R4	A11 circuit assembly gain	383 - 464Ω	8-47	5-16
A15R21	AGC loop gain, 2nd mixer output	2.15K - 5.6KΩ	8-44	5-12
A15R32	M1 OPERATE region	61.9K to 75KΩ	8-44	5-12
A16C10	Reference channel 278-kHz bandpass filter tuning	0 - 680 pF	8-38	5-13
A16R13	A16 circuit assembly gain	1.1K - 1.62K	8-38	5-13
8411A				
A4R14	Reference channel preamplifier gain	75 - 133Ω	8-29	5-20
A5R8	Test channel preamplifier gain	287Ω to open	8-29	5-23
A6R12	Phase lock loop gain	50 - 90.9Ω	8-32	5-21
A7C13	Phase lock loop gain	14 pF to open	8-32	5-21

Table 5-3. Listing of Available Factory Selected Components (1 of 2)

RESISTORS					
Value (Ω)	HP Part Number	Value (Ω)	HP Part Number	Value (Ω)	HP Part Number
10.0	0757-0346	562	0757-0417	31.6K	0698-3160
11.0	0757-0378	619	0757-0418	34.8K	0757-0123
12.1	0757-0379	681	0757-0419	38.3K	0698-3161
13.3	0698-3427	750	0757-0420	42.2K	0698-3450
14.7	0698-3428	825	0757-0421	46.4K	0698-3162
16.2	0757-0382	909	0757-0422	51.1K	0757-0458
17.8	0757-0294	1.0K	0757-0280	56.2K	0757-0459
19.6	0698-3429	1.1K	0757-0424	61.9K	0757-0460
21.5	0698-3430	1.21K	0757-0274	68.1K	0757-0461
23.7	0698-3431	1.33K	0757-0317	75.0K	0757-0462
26.1	0698-3432	1.47K	0757-1094	82.5K	0757-0463
28.7	0698-3433	1.62K	0757-0428	90.9K	0757-0464
31.6	0757-0180	1.78K	0757-0278	100K	0757-0465
34.8	0698-3434	1.96K	0698-0083	110K	0757-0466
38.3	0698-3435	2.15K	0698-0084	121K	0757-0467
42.2	0757-0316	2.37K	0698-3150	133K	0698-3451
46.4	0698-4037	2.61K	0698-0085	147K	0698-3452
51.1	0757-0394	2.87K	0698-3151	162K	0757-0470
56.2	0757-0395	3.16K	0757-0279	178K	0698-3243
61.9	0757-0276	3.48K	0698-3152	196K	0698-3453
68.1	0757-0397	3.83K	0698-3153	215K	0698-3454
75.0	0757-0398	4.22K	0698-3154	237K	0698-3266
82.5	0757-0399	4.64K	0698-3155	261K	0698-3455
90.0	0757-0400	5.11K	0757-0438	287K	0698-3456
100	0757-0401	5.62K	0757-0200	316K	0698-3457
110	0757-0402	6.19K	0757-0290	348K	0698-3458
121	0757-0403	6.81K	0757-0439	383K	0698-3459
133	0698-3437	7.50K	0757-0440	422K	0698-3460
147	0698-3438	8.25K	0757-0441	464K	0698-3260
162	0757-0405	9.09K	0757-0288	511K	0757-0135
178	0698-3439	10.0K	0757-0442	562K	0757-0868
196	0698-3440	11.0K	0757-0443	619K	0757-0136
215	0698-3441	12.1K	0757-0444	681K	0757-0869
237	0698-3442	13.3K	0757-0289	750K	0757-0137
261	0698-3132	14.7K	0698-3156	825K	0757-0870
287	0698-3443	16.2K	0757-0447	909K	0757-0138
316	0698-3444	17.8K	0698-3136	1M	0757-0059
348	0698-3445	19.6K	0698-3157	1.1M	0757-0139
383	0698-3446	21.5K	0757-0199	1.21M	0757-0871
422	0698-3447	23.7K	0698-3158	1.33M	0757-0194
464	0698-0082	26.1K	0698-3159	1.47M	0698-3464
511	0757-0416	28.7K	0698-3449		

Table 5-3. Listing of Available Factory Selected Components (2 of 2)

CAPACITORS					
Value (pF)	HP Part Number	Value (pF)	HP Part Number	Value (pF)	HP Part Number
9.1	0160-2256	39	0140-0190	180	0140-0197
10.0	0160-2257	43	0160-2200	200	0140-0198
11.0	0160-2258	47	0160-2307	220	0160-0134
12.0	0160-2259	51	0160-2201	240	0140-0199
13.0	0160-2260	56	0140-0191	270	0140-0210
15.0	0160-2261	62	0140-0205	300	0160-2207
16.0	0160-2262	68	0140-0192	330	0160-2208
18.0	0160-2263	75	0160-2202	360	0160-2209
20.0	0160-2264	82	0140-0193	390	0140-0200
22.0	0160-2265	91	0160-2203	430	0160-0939
24.0	0160-2266	100	0160-2204	470	0160-3533
27	0160-2306	110	0140-0194	510	0160-3534
30	0160-2199	120	0160-2205	560	0160-3535
33	0160-2150	130	0140-0195	620	0160-3536
36	0160-2308	150	0140-0196	680	0160-3537
		160	0160-2206		

ADJUSTMENTS

NOTE
Before any adjustments are made, allow 30 minutes warmup to obtain normal operating temperature on all components.

5-8. 8410B POWER SUPPLY ASSEMBLY A10A1.

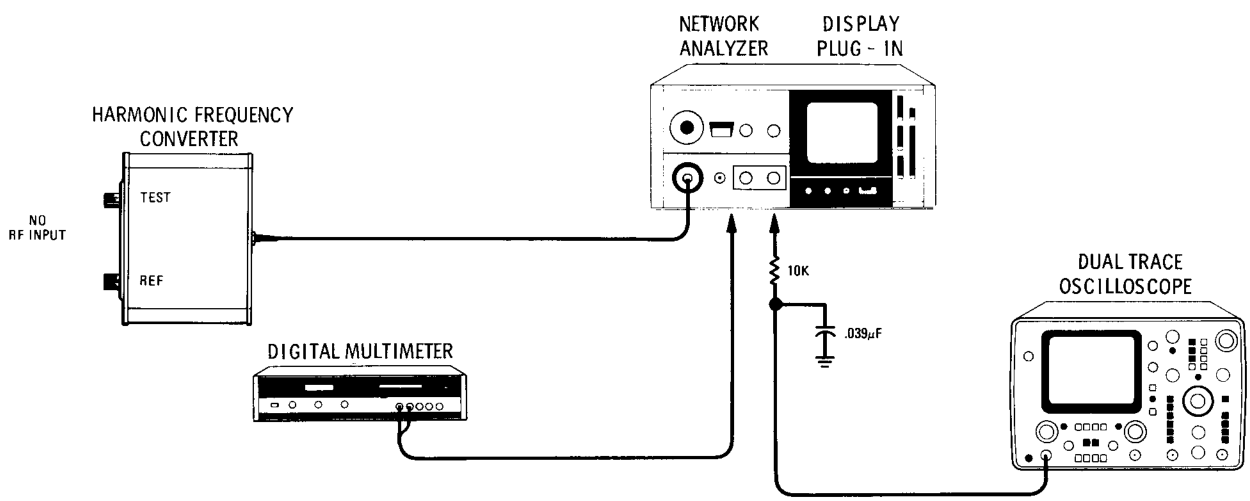
ADJUSTMENTS:

Adjust A10A1R9 and A10A1R22.

DESCRIPTION:

The 8410B +20 and −20 volt power supplies are each measured with a dc voltmeter and adjusted to ±20.00 volts. The ac ripple is monitored on an oscilloscope to check for proper filtering.

TEST SETUP:



TEST EQUIPMENT: Items 5, 10, and 11, Table 1-8.

PROCEDURE:

a. Connect equipment as shown in test setup above. Connect a 400 Hz low-pass filter consisting of a 10 Kilohm resistor and a 0.039μF capacitor to oscilloscope input as shown in test setup.

b. Remove 8410B top cover.

c. Turn on 8410B power.

d. Connect oscilloscope and dc voltmeter to test points below and make adjustments if necessary.

NOTE
Power supply voltages should not be adjusted unless very accurate measurement indicates that they are out of tolerance.

5-8. 8410B POWER SUPPLY ASSEMBLY A10A1. (Cont'd)

Test Point	DC Voltmeter Indication	Oscilloscope Waveform	Adjustment
A10A1TP2	−20.00 ±0.01 Vdc	5 mV p-p max.	A10A1R22*
A10A1TP1	+20.00 ±0.01 Vdc	5 mV p-p max.	A10A1R9*
A10A1TP3	−11.00 ±0.5 Vdc	5 mV p-p max.	none

*If either supply has to be adjusted, set as close as possible to ±20.00 V.

5-9. 8410B PHASE DETECTOR ASSEMBLY A5.

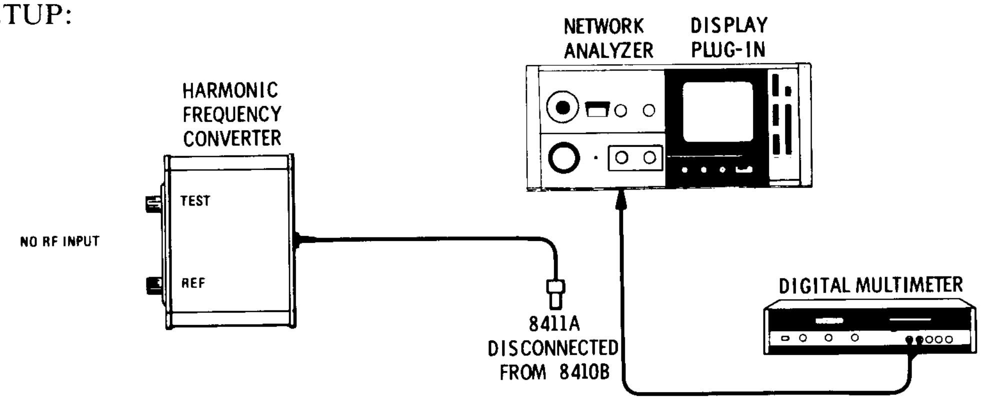
ADJUSTMENTS:

Select A5R3 and A5R6

DESCRIPTION:

The phase error signals at the output of phase detector assembly A5 (A5TP1 and A5TP3) should be zero with no RF signal applied to the 8410B input from the 8411A. The phase error signals from phase detectors A and B should be zero Vdc and are checked at the base of emitter followers A5Q1 and A5Q2. The zero Vdc signal produces a negative voltage at the emitters of A5Q1 and A5Q2. The emitters are connected to output test points A5TP1 and A5TP3 through diodes A5CR9 and A5CR10 which offset the negative voltage back to zero. Conduction through the diodes is adjusted to obtain zero dc output by selecting the resistance values of A5R3 ad A5R6.

TEST SETUP:



TEST EQUIPMENT: Items 10 and 11, Table 1-8.

PROCEDURE:

Select A5R3

a. Connect dc voltmeter to A5TP1. If indication is zero ±50 mV, phase detector A is operating correctly and no adjustment of A5R3 is necessary; proceed to step d and check phase detector B.

b. Connect dc voltmeter to A5Q1 base. If indication is zero ±50 mV, proceed to step c. If indication is not zero ±50 mV, troubleshoot phase detector A using procedures in Figure 8-52.

5-9. 8410B PHASE DETECTOR ASSEMBLY A5 (Cont'd)

c. Connect dc voltmeter to A5TP1 and select the value of A5R3 for zero ±50 mV indication. Typical range of values for A5R3 is 8250 ohms to 23.7 Kilohms.

Select A5R6

d. Connect dc voltmeter to A5TP3. If indication is zero ±50 mV, no adjustment of A5R6 is necessary and adjustment of phase detector assembly A5 is complete. If indication is not zero ±50 mV, proceed to step e.

e. Connect dc voltmeter to A5Q2 base. If indication is zero ±50 mV, proceed to step f. If indication is not zero ±50 mV, troubleshoot phase detector B using procedures in Figure 8-52.

f. Connect dc voltmeter to A5TP3 and select the value of A5R6 for zero ±50 mV indication. Typical range of values for A5R6 is 8250 ohms to 23.7 Kilohms.

5-10. 8410B SEARCH ASSEMBLY A8.

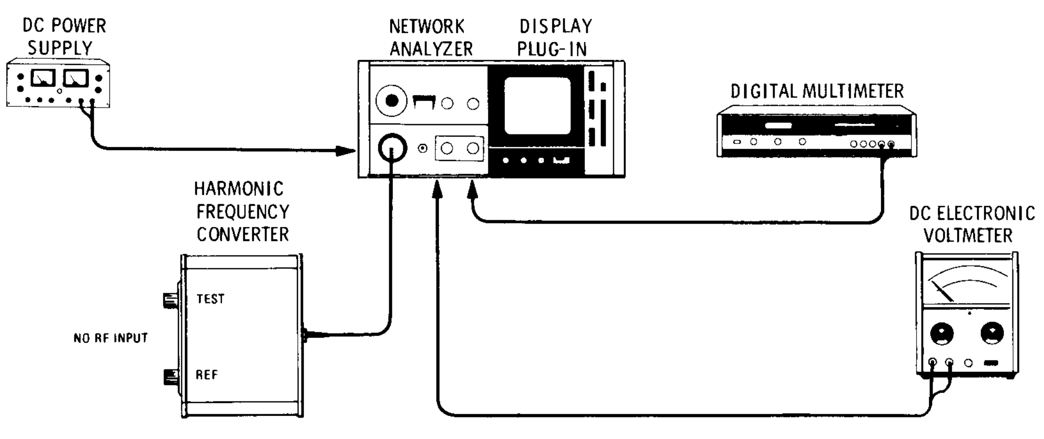
ADJUSTMENTS:

Select A8R2 and A8R39

DESCRIPTION:

Negative Schmitt trigger A8Q8-A8Q9 should trigger and reset on a phase-error signal between −150 mV and −200 mV. The trigger and reset points are positioned in this range by selecting the value of A8R39. Decreasing resistance of A8R39 shifts the trigger and reset points in the negative direction. Positive Schmitt trigger A8Q1-A8Q2 should trigger and reset on a phase-error signal between +135 and +215 mV. The trigger and reset points are positioned in this range by selecting the value of A8R2. Decreasing resistance of A8R2 shifts the trigger and reset points in the positive direction

TEST SETUP:



TEST EQUIPMENT: Items 9, 10, 11, and 12, Table 1-8.

ADJUSTMENTS

5-10. 8410B SEARCH ASSEMBLY A8 (Cont'd)

PROCEDURE:

a. Set external power supply to zero Vdc. Connect negative lead to A8TP1 and positive lead to ground. Connect digital voltmeter between A8TP1 and ground.

b. Connect dc voltmeter between A8TP5 and ground.

c. Slowly adjust power supply from zero to −250 mV and back to zero. Note trigger and reset points of Schmitt trigger on digital voltmeter by observing change on dc voltmeter. Dc voltmeter readings should range from about −3 Vdc to about −18 Vdc and back to −3 Vdc. If both trigger and reset points are in the range of −150 mV to −200 mV, no selection of A8R39 is necessary; proceed to step e. If both trigger and reset points are not in the range of −150 mV to −200 Mv, selection of A8R39 is necessary; proceed to step d.

d. Select value of A8R39 for both trigger and reset points in the range of −150 mV to −200 mV. Typical range of values for A8R39 is 82 to 121 ohms. Decreasing resistance of A8R39 shifts trigger point in the negative direction.

e. Set power supply to zero Vdc. Connect positive lead to A8TP1 and negative lead to ground. Connect digital voltmeter between A8TP1 and ground.

f. Connect dc voltmeter between A8TP2 and ground.

g. Slowly adjust power supply from zero to +250 mV and back to zero. Note trigger and circuit reset points of Schmitt trigger on digital voltmeter by observing change on dc voltmeter. Dc voltmeter readings should range from about +9 Vdc to about +19 Vdc and back to +9 Vdc. If both trigger and reset points are in the range of +135 mV to +215 mV, no selection of A8R2 is necessary; alignment procedure for search assembly A8 is complete. If both trigger and reset points are not +135 mV to +215 mV, selection of A8R2 is necessary; proceed to step h.

h. Select value of A8R2 for both trigger and reset points in the range of +135 mV to +215 mV. Typical range of values for A8R2 is 68 to 100 ohms. Decreasing resistance of A8R2 shifts trigger points in the positive direction.

5-11. 8410B 20-MHz OSCILLATOR ASSEMBLY A13.

ADJUSTMENTS:

Adjust A13C7 and Select A6C6.

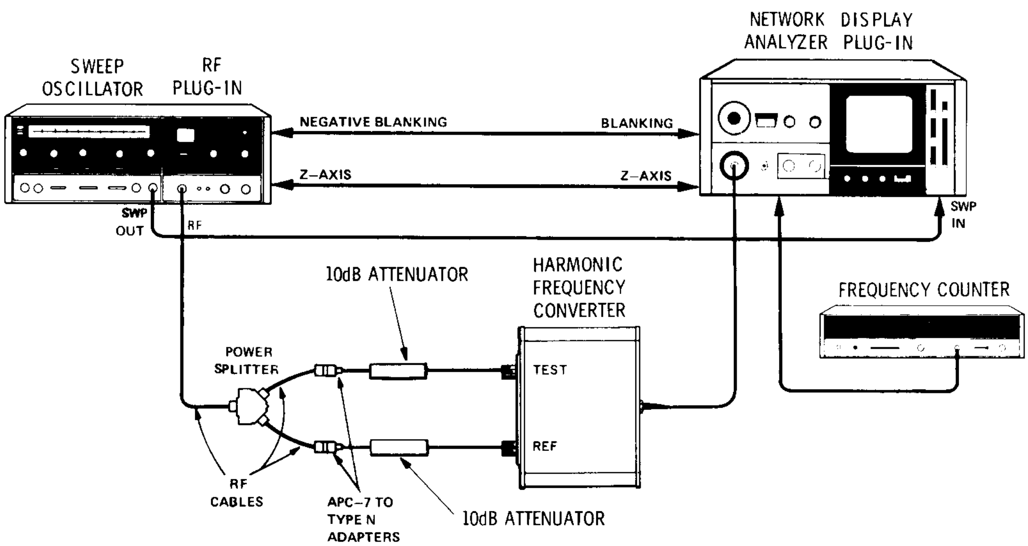
DESCRIPTION:

With the 8410B phase-locked, the frequency of the 20-MHz second local oscillator is adjusted to produce a second IF of 277.778 kHz ±0.077 kHz. If necessary, the 20.278 MHz oscillator in A6 is adjusted in frequency.

ADJUSTMENTS

5-11. 8410B 20 MHz OSCILLATOR ASSEMBLY A13

TEST SETUP:



TEST EQUIPMENT: Items 1, 8, 10, 14, 16, 20, 23, Table 1-8.

PROCEDURE:

a. Phase-lock 8410B as follows:$

1. Set signal source for single-frequency CW operation, any frequency from 110 MHz to 12.4 GHz (to 18 GHz if Option 018).

2. Set FREQ RANGE switch on 8410B to a position that includes the signal source frequency.

3. Set SWEEP STABILITY control to the CW detent position.

4. Adjust RF power from the signal source for REF CHANNEL LEVEL meter indication in the OPERATE range.

5. Set 8412 MODE Switch to PHASE and DEG/DIV Switch to 90. Adjust the PHASE VERNIER control. The dot on the CRT should be stable and move smoothly in a vertical direction.

b. Connect frequency counter to 8410B REF CHAN OUTPUT.

c. Adjust A13C7 for a frequency counter indication of 277.778 kHz ±0.077 kHz. If the frequency cannot be obtained, select a value of A6C6 that gives the correct frequency. The value of A6C6 is between 12 and 39 pf.

d. Check phase balance, paragraph 5-16 of this procedure.

5-12. 8410B AGC AMPLIFIER ASSEMBLY A15.

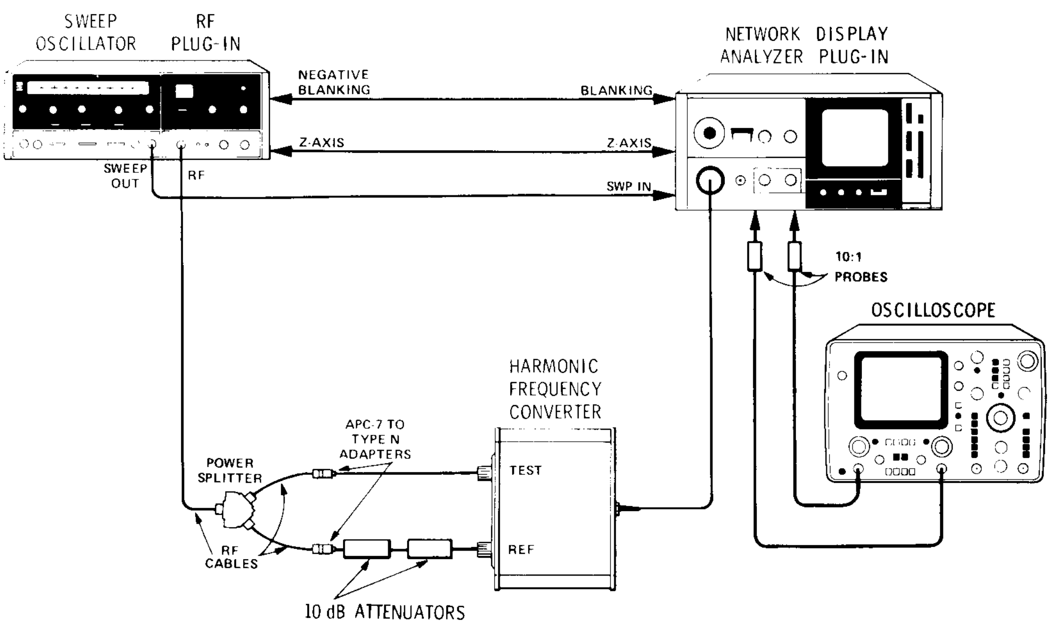
ADJUSTMENTS:

Select A15R21 and A15R32.

DESCRIPTION:

Loop gain through the AGC circuit is adjusted by monitoring overall gain through the reference channel IF amplifier A14. With the 8410B phase-locked, a reference signal level is set at the input of A14. The value of A15R21 is then selected to produce a specific signal amplitude at the outputs of A12 and A14.

TEST SETUP:



TEST EQUIPMENT: Items 1, 5, 10, 14, 16, 20, 23, Table 1-8.

5-12. 8410B AGC AMPLIFIER A15

PROCEDURE:

a. Phase-lock 8410B as follows:

   1. Set signal source for single-frequency CW operation, any frequency from 110 MHz to 12.4 GHz (to 18 GHz if Option 018).

   2. Set FREQ RANGE switch on 8410B to a position that includes the signal source frequency.

   3. Set SWEEP STABILITY control to the CW detent position.

   4. Adjust RF power from the signal source for REF CHANNEL LEVEL meter indication in the OPERATE range.

   5. Set 8412A MODE Switch to PHASE and DEG/DIV Switch to 90. Adjust the PHASE VERNIER control. The dot on the CRT should be stable and move smoothly in a vertical direction.

b. Connect oscilloscope X10 divider probe to A14TP4.

c. Adjust signal source output level for 100 mV ±5 mV peak to peak at oscilloscope.

d. Connect oscilloscope X10 divider probes to A12TP1 and A14TP1.

e. Select value of resistor A15R21 which produces a 220 mV ±30 mV peak-to-trough sine-wave signal on oscilloscope at both test points. Typical range of values for A15R21 is 2.15 Kilohm to 5.62 Kilohm.

f. Check the REF. CHANNEL LEVEL meter (M1) indication. Select values of resistor A15R32 which produces an indication at the high end of OPERATE region. Typical range of values for A15R32 is 61.9K to 75K ohms.

5-13. 8410B REFERENCE 278-kHz AMPLIFIER ASSEMBLY A16.

ADJUSTMENTS:

Select A16C10 and A16R13.

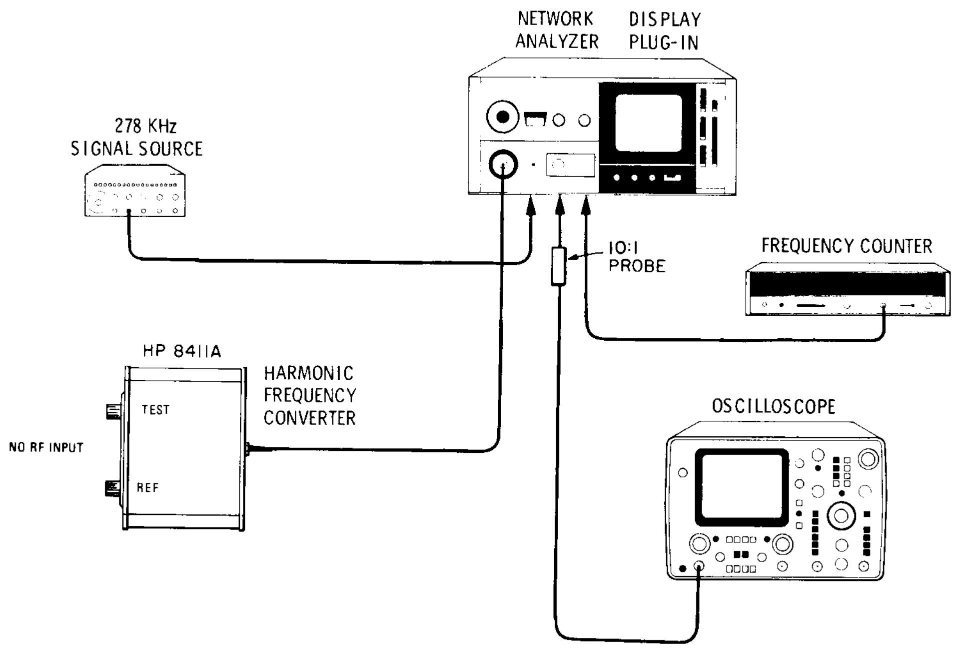
DESCRIPTION:

Bandpass filter at the output of A16 is adjusted for center frequency of 278 kHz by selecting the value of A16C10. Gain through A16 is adjusted by selecting the value of A16R13. Gain is determined by comparing a known 278 kHz signal applied to A16 input to the signal amplitude at the output of A16.

ADJUSTMENTS

5-13. 8410B REFERENCE 278-kHz AMPLIFIER ASSEMBLY A16. (Cont'd)

TEST SETUP



TEST EQUIPMENT: Items 5, 8, 10, and 13, Table 1-8.

PROCEDURE:

a. Remove A12 and A14 circuit board assemblies. Set 8410B PHASE VERNIER control to mid position.

b. Connect 278 kHz signal source and oscilloscope to A16TP1. Adjust signal source output to 220 mV peak to peak as displayed on oscilloscope.

c. Connect oscilloscope to A16TP3, and frequency counter to rear-panel REF CHAN OUT connector.

d. Adjust signal source through 278 kHz and note if maximum signal on oscilloscope occurs at 278 kHz ±2 kHz. If not, select the value of A16C10 for maximum signal at 278 kHz ±2 kHz. Typical range of values for A16C10 is zero to 680 pF.

e. Check if signal amplitude at A16TP3 is 2.3 volts ±0.3 volts peak to peak. If not, select the value of A16R13 for correct amplitude. Typical range of values for A16R13 is 1.1 Kilohm to 1.62 Kilohm.

f. Disconnect signal source and reinstall A12 and A14 circuit board assemblies.

ADJUSTMENTS

5-14. 8410B CHANNEL PHASE VARIATION OVER AGC RANGE.

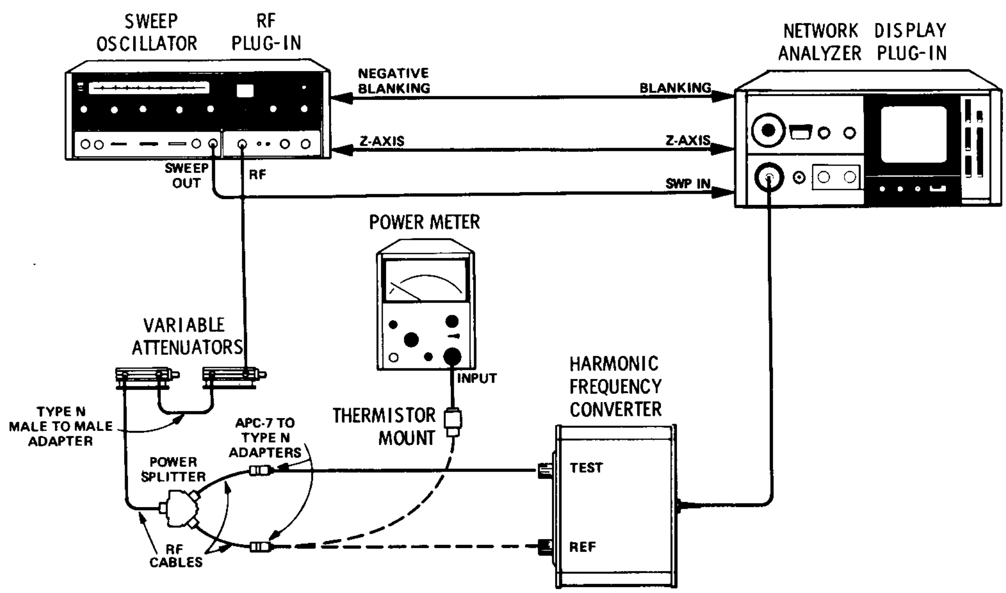
ADJUSTMENTS

Adjust A12L2 and A14L2.

DESCRIPTION:

The input RF signal level at the 8411A is Varied across the AGC range and A14L2 and A12L2 are adjusted for minimum phase change over the AGC range.

TEST SETUP:



TEST EQUIPMENT: Items 1, 2, 10, 14, 20, 23, 24, 26, 27, 28, Table 1-8.

PROCEDURE:

a. Change equipment test setup as shown above with power meter thermistor mount connected to cable from power splitter.

b. Set signal source to CW mode and any frequency between 110 MHz and 12.4 GHz.

c. Set 1 dB/step variable attenuator to zero dB and adjust output level of signal source and 10 dB/step variable attenuator for −18 dBm indication on power meter.

d. Disconnect thermistor mount from cable to power splitter and connect 8411A REFERENCE port to cable.

e. Check for 8410B phase-lock as follows:

   1. Set 8410B FREQ RANGE switch to include signal source frequency and SWEEP STABILITY control to CW detent position.

ADJUSTMENTS

5-14. 8410B CHANNEL PHASE VARIATION OVER AGC RANGE (Cont'd)

2. Set 8412A MODE Switch to PHASE and DEG/DIV Switch to 90. Adjust the PHASE VERNIER control. The dot on the CRT should be stable and move smoothly in a vertical direction.

f. Set 8412A DEG/DIV Switch to 1.0 and position CRT dot to center horizontal graticule line with 8410B PHASE VERNIER control.

g. Slowly insert 17 dB of attenuation with variable attenuators while observing CRT dot on 8412A display. Adjust A12L2 and A14L2 for minimum phase change across AGC range.

5-15. 8410B SWEEP STABILITY CIRCUIT IN CW MODE.

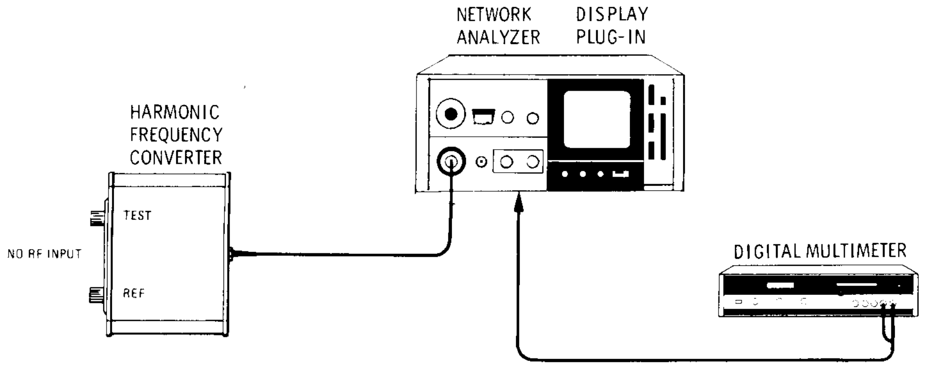
ADJUSTMENT:

Adjust A7R10.

DESCRIPTION:

In CW operation, the SWEEP STABILITY control is set to CW position, placing a fixed voltage on the 8411A VTO, centering the VTO frequency for proper search mode. A7R10 is adjusted for a VTO control voltage of +11.1 Vdc at A7TP6.

TEST SETUP:



TEST EQUIPMENT: Items 10 and 11, Table 1-8.

PROCEDURE:

a. Connect dc voltmeter to 8410B-A7TP6.

b. Set FREQ RANGE, switch to 8.0 to 16.0 GHz.

c. Set SWEEP STABILITY control to CW detent position.

d. Adjust A7R10 for +11.1 Vdc ±0.01 Vdc indication on dc voltmeter.

ADJUSTMENTS

5-16. 8410B AMPLITUDE ATTENUATOR AMPLIFIER ASSEMBLY A11.

ADJUSTMENTS:

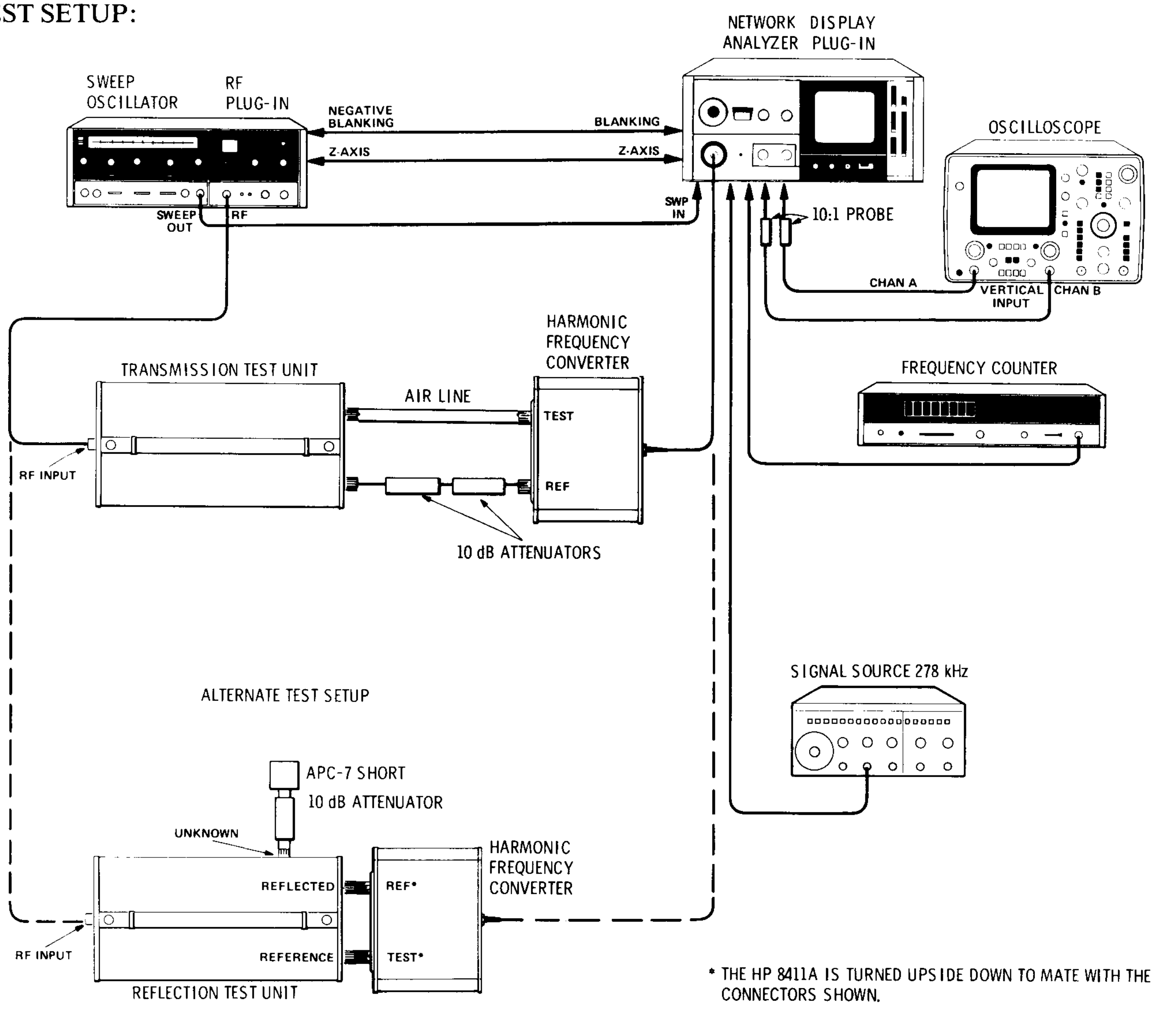
Select A11C1, A11C5, A11C7, and A11R4.

DESCRIPTION:

The 278 kHz bandpass filter in A11 is adjusted by selecting the value of A11C5.
Gain through A11 is adjusted by selecting the value of A11R4.

With in-phase signals applied to the 8410B and with the PHASE VERNIER control at mid-range, the output of the test channel should lead the reference channel by +50 degrees. The +50 degree phase difference is adjusted by selecting the values of A11C1 and A11C7.

TEST SETUP:



TEST EQUIPMENT: Items 1, 4, 5, 8, 10, 13, 16, 17, 21, 24, Table 1-8.

ADJUSTMENTS

5-16. 8410B AMPLITUDE ATTENUATOR AMPLIFIER ASSEMBLY A11. (Cont'd)

PROCEDURE:

a. Phase lock 8410B as follows:
   1. Set signal source for single-frequency CW operation and frequency from 110 MHz to 12.4 GHz (to 18 GHz if Option 018).
   2. Set FREQ RANGE switch on 8410B to a position that includes the signal source frequency.
   3. Set SWEEP STABILITY control to CW position.
   4. Adjust RF power from the signal source for REF CHANNEL LEVEL meter indication in the OPERATE range.
   5. Set 8412A MODE Switch to PHASE and DEG/DIV Switch to 90. Adjust the PHASE VERNIER control. The dot on the CRT should be stable and move smoothly in a vertical direction.

Tune 278-kHz Bandpass Filter

b. Remove A12 circuit board assembly.

c. Connect 278-kHz signal source and oscilloscope to A11TP1. Adjust signal source to 220 mV ±5 mV peak to peak as displayed on oscilloscope.

d. Connect oscilloscope 10:1 probe to A11TP3, and connect frequency counter to rear-panel TEST CHAN OUTPUT. Set TEST CHANNEL GAIN and AMPL VERNIER controls for sufficient signal to operate counter.

e. Adjust signal source through 278 kHz and note if maximum signal on oscilloscope occurs at 278 kHz ±2 kHz. If not, select the value of A11C5 for maximum signal at 278 kHz. Typical range of values for A11C5 is zero to 75 pF.

Adjust Gain through A11.

f. Check if signal amplitude at A11TP3 is 10 volts ±1 volt peak to peak. If not, select the value of A11R4 for correct amplitude. Typical range of values for A11R4 is 383 to 464 ohms.

g. Disconnect signal source and reinstall A12 Circuit Board Assembly.

Adjust Phase Shift through A11.

h. Connect 10:1 probes of dual trace oscilloscope to 8410B at A12TP4 and A14TP4.

i. Adjust 8740A REFERENCE PLANE EXTENSION to superimpose the two waveforms on the oscilloscope.

j. Set the PHASE VERNIER control to mid-range as follows:
   1. Turn PHASE VERNIER to maximum counterclockwise position and note phase indication on 8412A.
   2. Turn PHASE VERNIER to maximum clockwise position and note phase indication on 8412A.
   3. Set PHASE VERNIER for phase indication on 8412A midway between the points noted in steps (1) and (2) above.

k. Phase indication on 8412A should be +50 degrees ±15 degrees. If not, select the values of A11C1 and A11C7 for indication of +50 degrees ±15 degrees. Typical range of values for A11C1 is 100 to 270 pF, and for A11C7 is 240 to 360 pF.

l. Recheck gain by performing steps b through g.

ADJUSTMENTS

5-17. 8410B AUTOMATIC CONTROL ASSEMBLY A9.

ADJUSTMENTS:

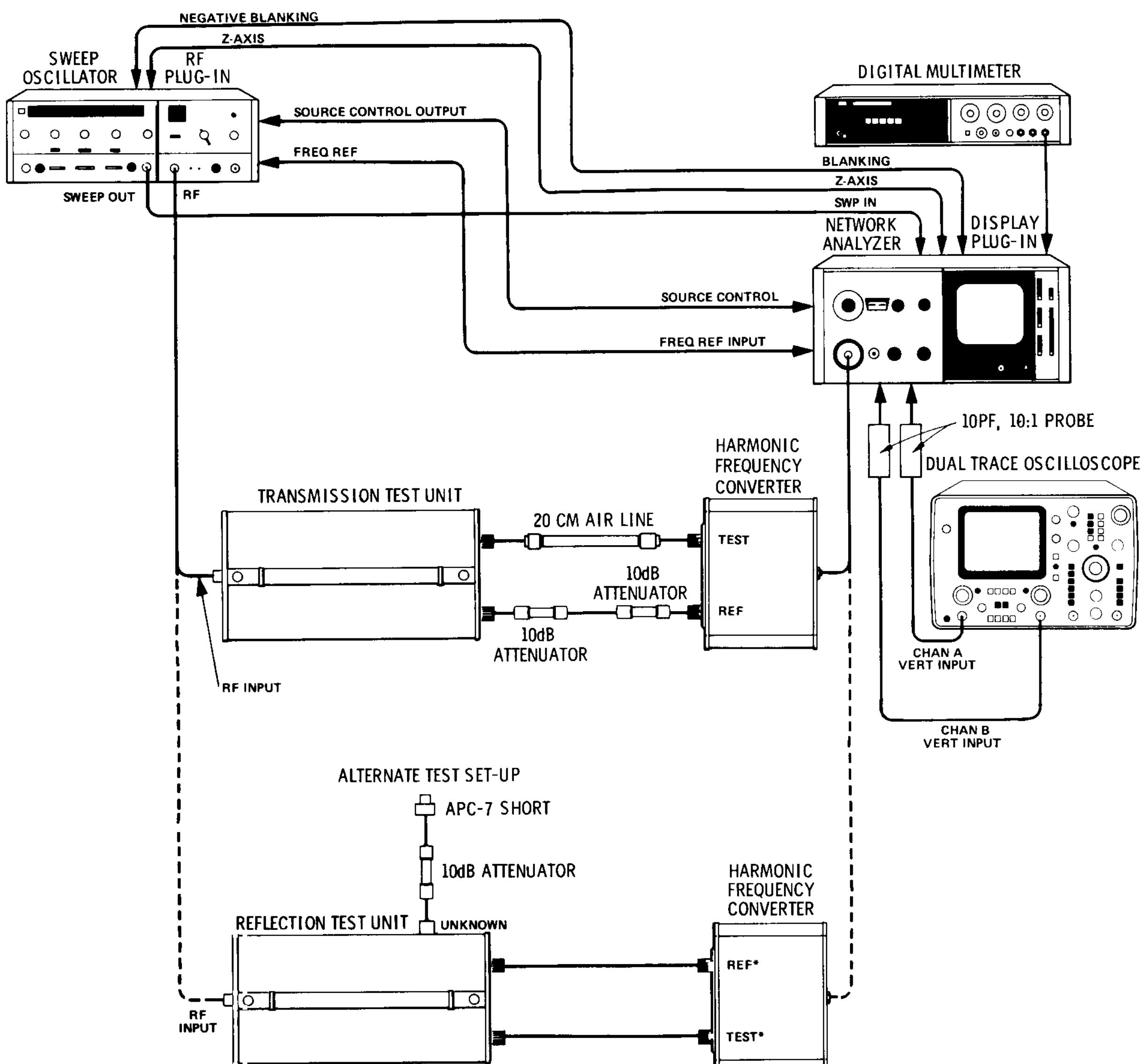
Adjust A9R9 and A9R17.

DESCRIPTION:

The VTO Trigger Threshold (A9R9) is adjusted to ensure the automatic relocking cycle is triggered when the 8411A VTO reaches the upper limits of frequency range.

The Sweep Delay is adjusted to give the 8410B enough time to stabilize after phase locking.

TEST SETUP:



*THE HP8411A IS TURNED UPSIDE DOWN TO MATE WITH THE CONNECTORS SHOWN.

TEST EQUIPMENT: Items 1, 4, 5, 10, 11, 16, 17, 21, and 25, Table 1-8.

ADJUSTMENTS

5-17. 8410B AUTOMATIC CONTROL ASSEMBLY A9 (Cont'd)

PROCEDURE:

a. Connect DVM between A9TP1 and chassis ground. Adjust VTO trigger threshold THR (A9R9) for 11.10 Vdc ±0.01 Vdc.

b. Phase lock 8410B as follows:

   1. Set sweep oscillator to sweep over less than one octave band. (For example 2.5 GHz to 3.5 GHz).
   2. Set FREQ RANGE (GHz) switch on 8410B to AUTO position.
   3. With the sweep oscillator set to a slow sweep time, adjust RF power from the sweep oscillator for REF CHANNEL LEVEL meter indication in the middle of the OPERATE range. Reset sweep time to a faster sweep.
   4. Set SWEEP STABILITY for best display on 8412A.
   5. Adjust 8410B PHASE VERNIER control; phase indication on 8412A should change smoothly, indicating the 8410B is tracking properly.

c. Connect Channel A probe of oscilloscope to 8410B-A9TP2 and Channel B probe to A9TP3. Set vertical sensitivity of oscilloscope to 5V/DIV and horizontal to 0.2 ms/DIV. Set vertical display of oscilloscope to A+B and trigger to internal A with positive slope. Set oscilloscope trigger level and 8410B SWEEP STABILITY controls for a stable trace.

d. Adjust Sweep Delay DLY (A9R17) for a positive pulse of 1.6 ms ± 0.1 ms duration.

5-18. 8410B A/D CONVERTER A18

ADJUSTMENT:

Adjust A18R2.

DESCRIPTION:

The frequency range switching points in AUTO mode are affected by the A/D reference voltage set by A18R2. For this adjustment no test setup is required.

PROCEDURE:

a. Connect DVM between 8410B-A18TP8 and chassis ground. Adjust A18R2 A/D ADJ for 11.25 Vdc ±0.01 Vdc.

NOTE ON 8411A ADJUSTMENTS

Repair of the 8411A will be necessary if it can not be adjusted to meet the limits given in this procedure. There are Service Hints at the end of this section to make the adjustments easier, and as an aid in troubleshooting. Repair to the 8411A should not be attempted until these adjustment procedures have been tried.

These procedures assume that a calibrated 8410B Network Analyzer is used and that the 8411A Harmonics Frequency Converter is an Option 018 (18 GHz Operation). However, the procedures will work for the standard 8411A (12.4 GHz).

Before adjustment to the 8411A is started, the 8410B VTO control voltage should be readjusted to 11.1 volts per paragraph 5-15.

ADJUSTMENTS

5-19. 8411A VTO CHECK AND ADJUSTMENT

NOTE

The 8411A covers should be removed and the special test cover (HP Part No. 08411-60035) installed. The 8411A should be allowed to warm up for two hours before adjustments.

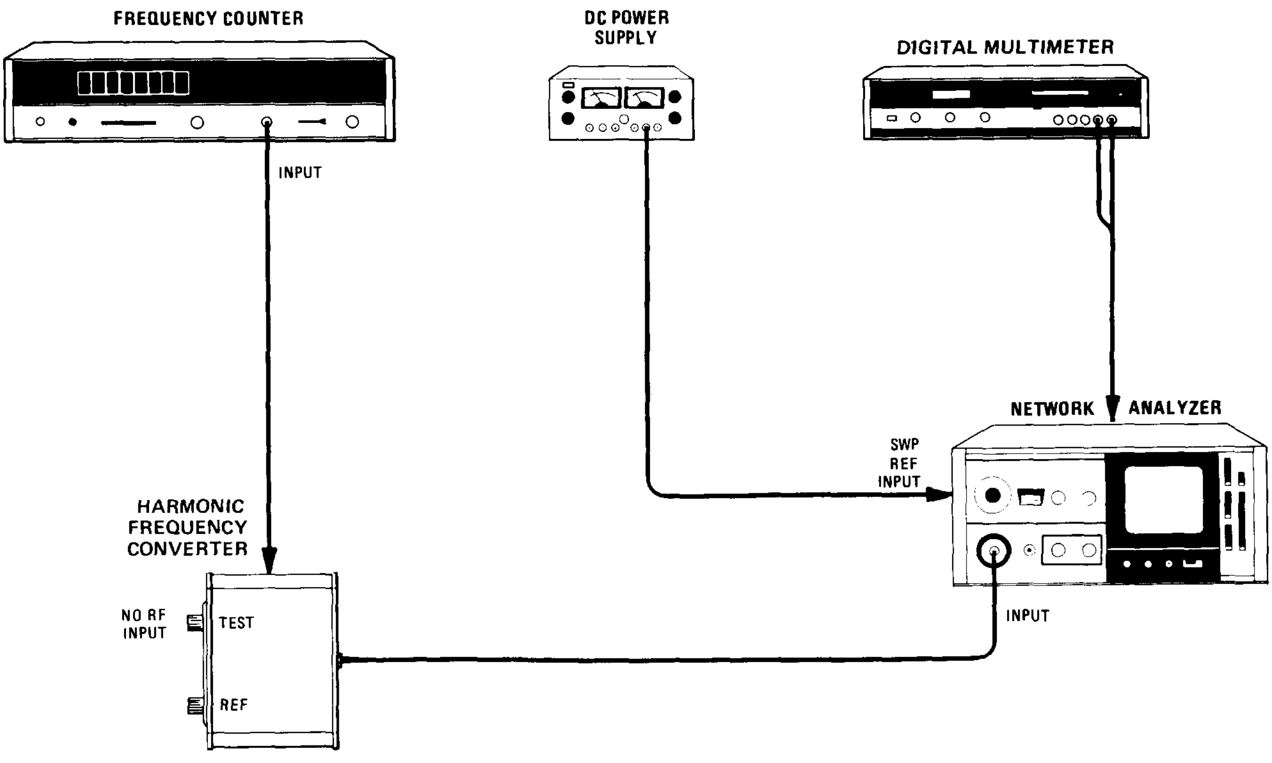
ADJUSTMENTS:

Adjust A6R2, A6R16, A7R5, and A7R19.

DESCRIPTION:

The VTO upper limit VTO (A6R16), the low frequency clamp adjust (A7R19), and the 65 MHz adjust (A7R5) are adjusted, to ensure the VTO will tune over its maximum frequency range linearly.

TEST SETUP:



TEST EQUIPMENT: Items 8, 9, 10, 11, and 29, Table 1-8.

PROCEDURE:

a. Connect equipment as shown in Test Setup.

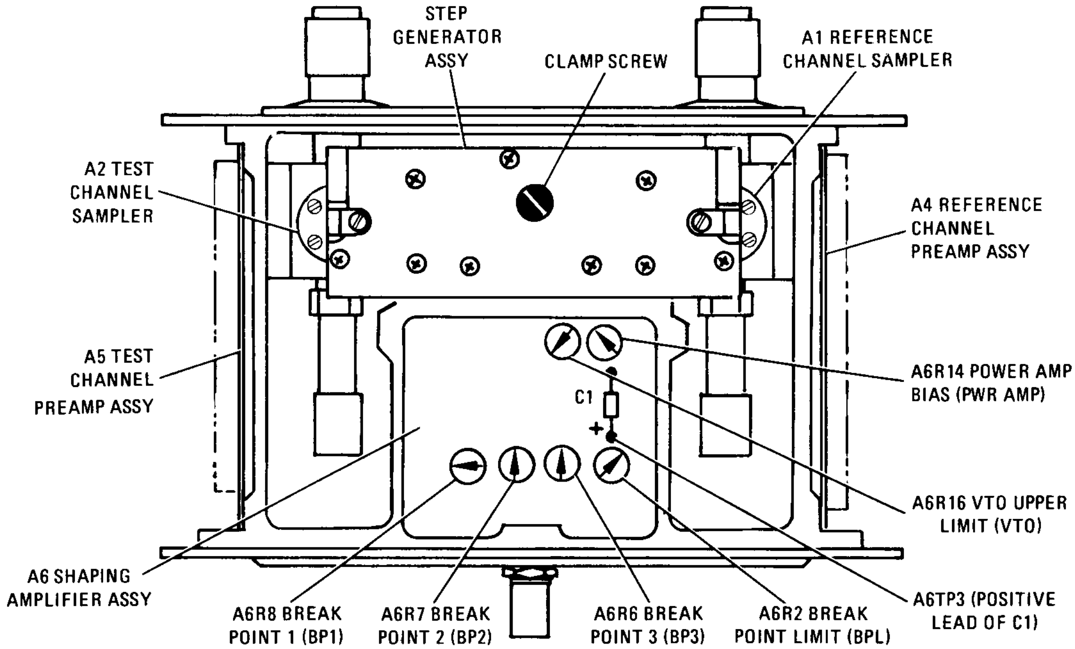
b. Remove the 8410B-A8 assembly and ground A7TP1.

c. Set power supply to +20 Volts and connect to 8410B Sweep Reference input.

5-19. 8411A VTO CHECK AND ADJUSTMENT (Cont'd)

d. Preset the 8411A-A6 adjustment potentiometers as shown in Figure 5-1, drawing A.

A (BOTTOM)



B (TOP)

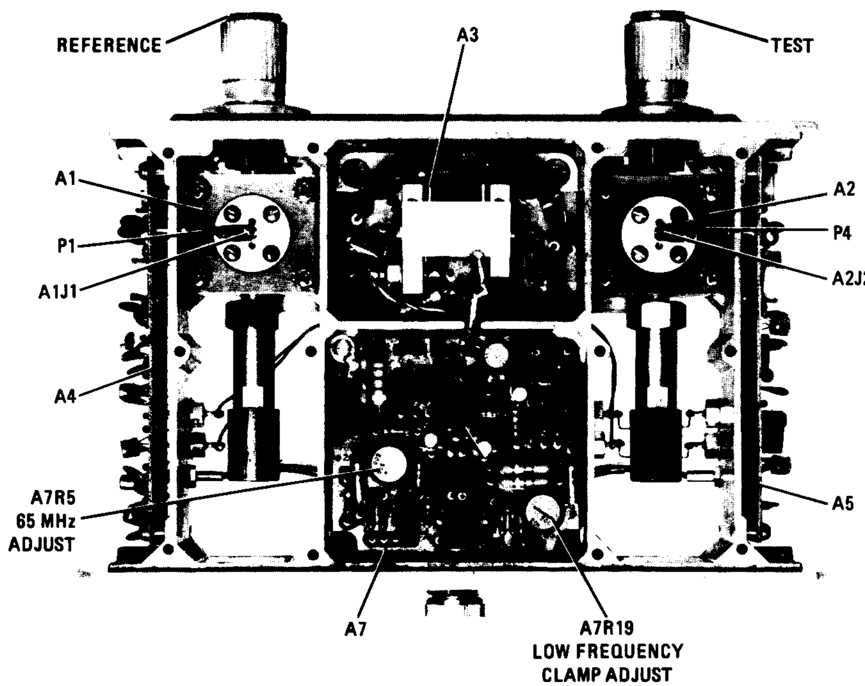


Figure 5-1. 8411A Adjustments Location and Preset Position

ADJUSTMENTS

5-19. 8411A VTO CHECK AND ADJUSTMENT (Cont'd)

e. Set 8410B SWEEP STABILITY control to CW detent position. Adjust 8411A BPL (A6R2) for 11.20 Vdc ±0.05 Vdc at A6TP3. See Figure 5-1, drawing A for location of A6TP3.

f. Monitor the VTO frequency with RF Pick-Up Loop (on test cover) and Frequency Counter. Adjust power supply and 8410B SWEEP STABILITY Control for 11.6Vdc ± 0.01Vdc at 8410B-A7TP6 and adjust 8411A VTO Upper Limit (A6R16) for 155 MHz ± 1 MHz.

g. Set power supply for negative voltage and adjust 8410B SWEEP STABILITY Control and power supply for 8.00 Vdc ± 0.01 Vdc at 8410B-A7TP6. Adjust low frequency clamp (A7R19) for 62.5 MHz ± 0.2 MHz.

h. Set power supply and sweep stability control for 9.40 Vdc ± .02 Vdc. Adjust 65 MHz adjust (A7R5) for 65 MHz ± 0.2 MHz. (See Service Hint 1.)

i. Recheck the 62.5 MHz. There is some interaction between the last two adjustments and some iteration of the adjustments will be necessary.

5-20 8411A A4 REFERENCE AND A5 TEST CHANNEL PREAMPLIFIER BIAS CENTERING, BIAS, CONVERSION EFFICIENCY, AND POWER AMPLIFIER GAIN

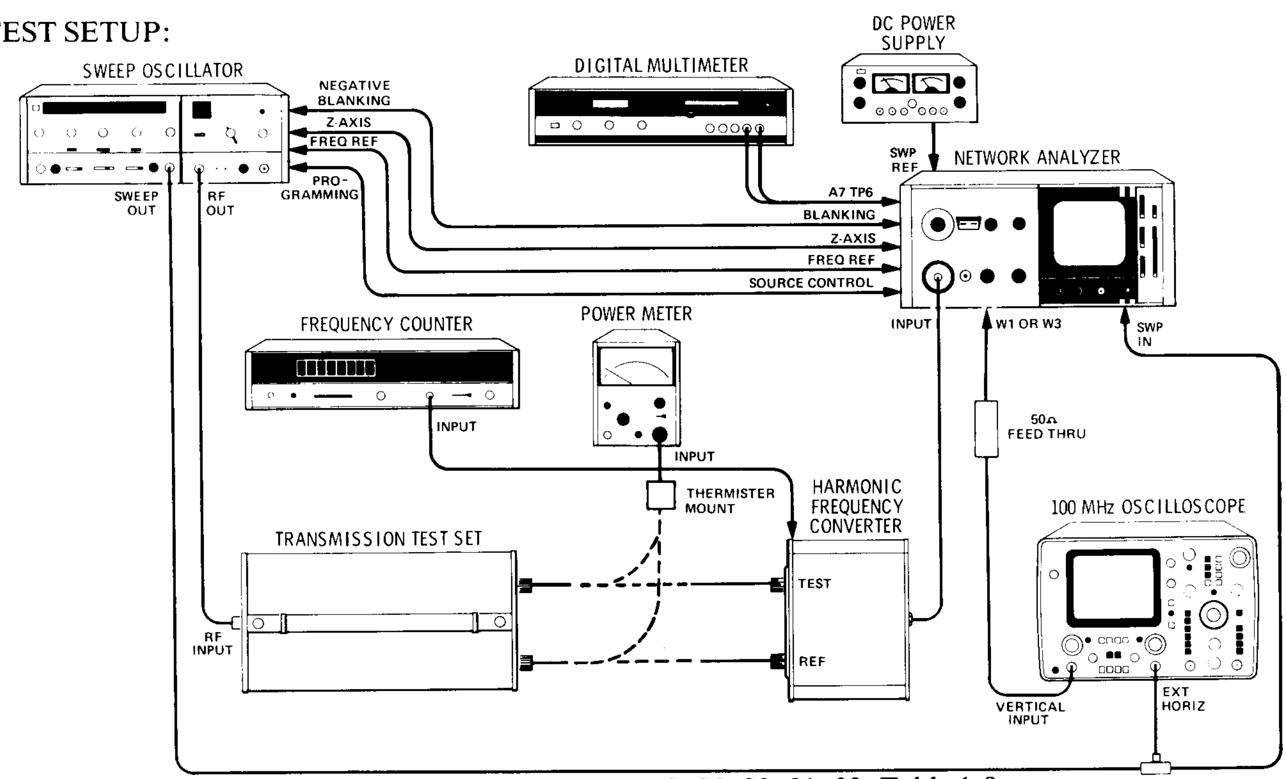
ADJUSTMENTS:

A4R3, A4R5, A5R3, A5R5, and A6R14, and select A4R14.

DESCRIPTION:

The 8411A Sampler diode bias supplies are adjusted to balance the response of the diode pairs and the bias adjust is adjusted for the best broadband frequency response of the diodes. The power amplifier is adjusted for maximum gain at the IF frequency. The AC gain of the reference preamplifier is set for a 8411A conversion efficiency of one. The gain and phase offset of the test amplifier is adjusted.

TEST SETUP:



TEST EQUIPMENT: Items 1, 2, 4, 5, 8, 9, 10, 11, 22, 25, 29, 31, 32, Table 1-8.

ADJUSTMENTS

5-20. 8411A A4 REFERENCE AND A5 TEST CHANNEL PREAMPLIFIER BIAS CENTERING, BIAS, CONVERSION EFFICIENCY, AND POWER AMPLIFIER GAIN (Cont'd)

PROCEDURE:

a. Connect equipment as shown in the Test Setup with the power meter thermistor mount connected to the transmission test set TEST port, and the dc power supply set to approximately +20 Volts.

b. Disconnect cable 8410B-W3P1 (Blue band) from J8 and connect oscilloscope through a 50 ohm load to 8410B-W3P1 (the output of the test channel).

c. Remove the 8410B-A8 assembly and connect A7 TP1 to ground.

d. Set 8410B SWEEP STABILITY control and power supply for a VTO frequency of 155 MHz.

e. Set 8620C for CW frequency of approximately 2.2 GHz and a ΔF of approximately 400 MHz. Set power level to −18 dBm. Disconnect thermistor mount and connect 8411A TEST port to test set. Adjust frequency controls for display on oscilloscope similar to Figure 5-2. It may be necessary to adjust A6R14 from its preset position for maximum birdie amplitude.

f. Set bias adjust (A5R5) until the oscilloscope display is approximately 10 percent of the peak-to-peak amplitude.

g. Adjust bias centering (A5R3) for minimum birdie amplitude. If the birdies go into the noise, increase the signal level by adjusting A5R5. Continue to adjust A5R3 for minimum birdie amplitude. Minimum birdie amplitude should occur with A5R3 near its center position. If it must be adjusted more that ±45 degrees from center, or balancing cannot be achieved, one of the diodes is defective and the sampler should be replaced. Refer to Paragraph 8-42 for sampler replacement procedure.

h. Adjust Power Amp (A6R14) for maximum (peak) birdie amplitude.

i. Reset A5R5 for maximum gain (fully clockwise).

j. Remove oscilloscope connection from W3P1 and reconnect W3P1 to J8. Disconnect 8410B-W1P1 from J7 and connect oscilloscope to W1P1 through a 50 ohm load. The oscilloscope display should be similar to Figure 5-3.

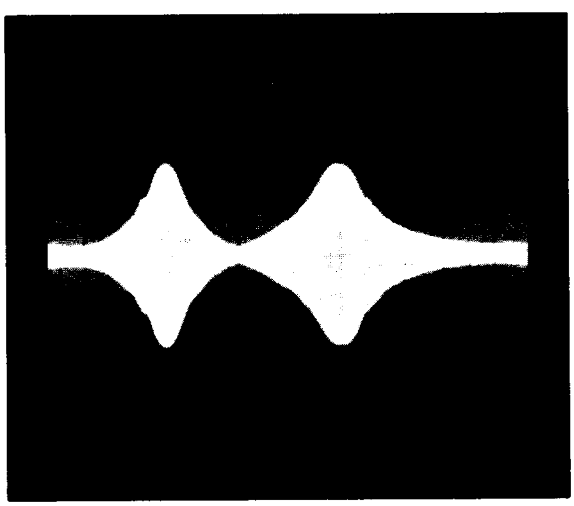


Figure 5-2. Test Channel IF Bandpass Birdies

ADJUSTMENTS

5-20. 8411A A4 REFERENCE AND A5 TEST CHANNEL PREAMPLIFIER BIAS CENTERING, BIAS, CONVERSION EFFICIENCY, AND POWER AMPLIFIER GAIN (Cont'd)

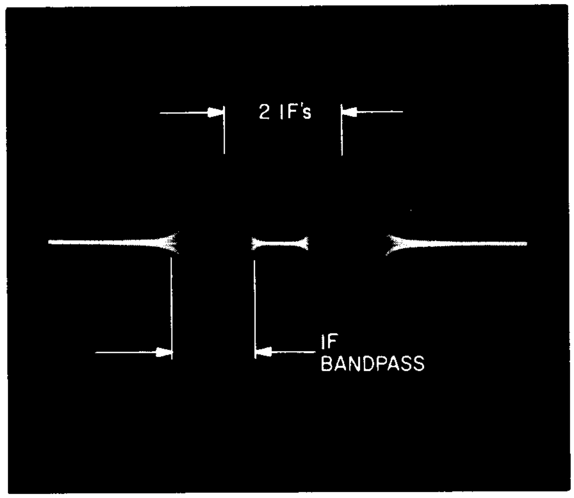


Figure 5-3. Reference Channel IF Bandpass Birdies

k. Adjust BIAS ADJUST (A4R5) counterclockwise until the oscilloscope display is approximately 20 percent of the peak-to-peak amplitude.

l. Adjust bias centering (A4R3) for minimum birdie amplitude. If the signal goes into the noise, increase signal level by adjusting A4R5, and continue to adjust A4R3 for minimum birdie amplitude. Adjust A4R5 to obtain a birdie pattern approximately three times the noise level.

m. Set 8620C for full band sweep (band 3) 12-18 GHz. Adjust BIAS ADJUST (A4R5) for maximum birdie amplitude at 18 GHz with minimum decrease of amplitude at the beginning of the sweep.

n. Disconnect power supply from 8410B SWP REF input. Remove jumper from 8410B-A7TP1 and ground, and reinstall A8 assembly. Reconnect 8410B-W1P1 to J7.

o. Set 8620C for 2 — 18 GHz sweep. Set 8410B frequency range for AUTO. Set sweep stability for best display stability. It may be necessary to reduce sweep speed.

NOTE

It may be necessary to perform test on Paragraph 5-21 at this point if a stable trace is not obtainable.

p. Adjust A5R5 for best overall frequency response on display with minimum amplitude skipping at the stop sweep points. The sweep stability control should be adjusted over the maximum lock range during this adjustment. Lowering the power amp gain slightly may improve the amplitude skipping.

q. Set 8620C for 0.11 to 2 GHz sweep (using 86222A/B), set 8410B frequency range switch to AUTO, and set sweep stability control for a stable sweep.

r. Reference channel bias adjust A4R5 may need a slight adjustment clockwise to reduce amplitude jitter. The test channel bias adjust A5R5 may also need a slight adjustment to reduce the amplitude jitter. (See Service Hints 3 and 4.)

ADJUSTMENTS

5-20. 8411A A4 REFERENCE AND A5 TEST CHANNEL PREAMPLIFIER BIAS CENTERING, BIAS, CONVERSION EFFICIENCY, AND POWER AMPLIFIER GAIN (Cont'd)

s. Remove 8410B-A8 assembly and connect ground to A7TP1. Set 8620C for a CW frequency of 2.2 GHz and a ΔF of ≈400 MHz. Set 8411A VTO frequency to 100 MHz using 8410B SWEEP STABILITY control.

t. Disconnect cable 8410B-W1P1 (Red band) from J7. Connect oscilloscope through 50 ohm load to 8410B-W1P1 (the output of the reference channel).

u. Apply −20 dBm, 2.0 to 2.4 GHz signal to 8411A REFERENCE port. Select A4R14 for a peak-to-peak signal of 62.5 mV ± 7 mV on oscilloscope. (See Service Hint 2.)

NOTE

62.5 mV ± 7 mV corresponds to −20 dBm ± 1 dBm. A spectrum analyzer can be used if a 100 MHz oscilloscope is not available.

v. Remove ground jumper from 8410B A7TP1 and reinstall 8410B A8 Assembly. Reconnect 8410B-W1P1 to J7.

5-21. 8411A A6 VTO TUNING VOLTAGE SHAPING AMPLIFIER

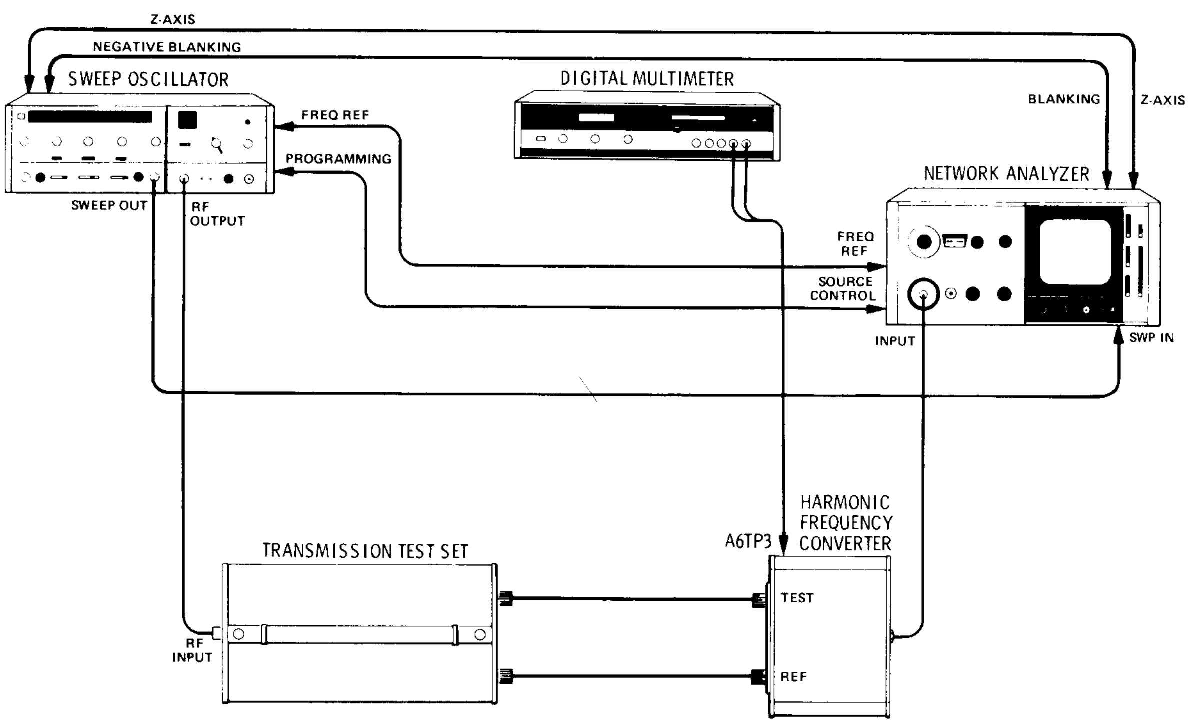
ADJUSTMENTS:

A6R2, A6R6, A6R7, A6R8, and select A6R12, and A7C13.

DESCRIPTION:

The VTO tuning voltage is shaped to provide maximum range of the tuning stabilizer control.

TEST SETUP:



TEST EQUIPMENT: Items 1, 4, 10, 11, and 25, Table 1-8.

5-21. 8411A A6 VTO TUNING VOLTAGE SHAPING AMPLIFIER (Cont'd)

PROCEDURE:

a. Check the VTO frequency per paragraph 5-19, omitting step d.

b. Connect equipment as shown in the Test Setup. Connect DC voltmeter to 8411A-A6TP3. Remove ground jumper from 8410B A7TP1 and reinstall 8410B A8 assembly.

c. Set 8620C for 4 to 8 GHz sweep.

d. Set 8410B Freq Range Control for 4 to 8 GHz.

e. Adjust break point limit BPL (A6R2) for 11.20 Vdc ± 0.05 Vdc.

f. Set 8410B Sweep Stability control for best trace without breakup (loss of phase lock). Note the position of the knob. Phase lock loop oscillations induced by VTO shaping will appear on the display as power holes. (See Figure 5-9). To verify that the power hole is caused by loop oscillations, vary the Sweep Stability control. If the power hole moves along the display, it is caused by loop oscillations. If it does not vary across the display, it is a true RF power hole. (See Service Hint 5).

g. Rotate Sweep Stability control 10 degrees clockwise and then counterclockwise from the position noted. If the 8410B breaks phase lock, adjust BP1 (A6R8). BP1 (A6R8) should be adjusted to give the maximum range of the Sweep Stability control without losing phase lock.

h. Move the Frequency Range switch one position clockwise and then one position counterclockwise. The Sweep Stability control should be adjustable to give a complete trace without loss of phase lock or loop oscillations. If oscillations can not be eliminated, adjust BP2 (A6R7) and BP3 (A6R6). It may be necessary to change the value of A6R12 from 90.9 ohm to 75 ohm if oscillations cannot be eliminated with BP2 and BP3. Also, the value of A7C13 may need to be increased to decrease phase lock loop gain.

i. Set 8620C for 2-18.0 GHz sweep and 8410B FREQ. RANGE to AUTO. Adjust Sweep Stability for best trace without breakup (loss of phase lock). Make final adjustment of BP2 (A6R7) and BP3 (A6R6) if necessary for best results. If oscillation persists, see Service Hints 3 and 4.

5-22. 8411A CHANNEL ISOLATION

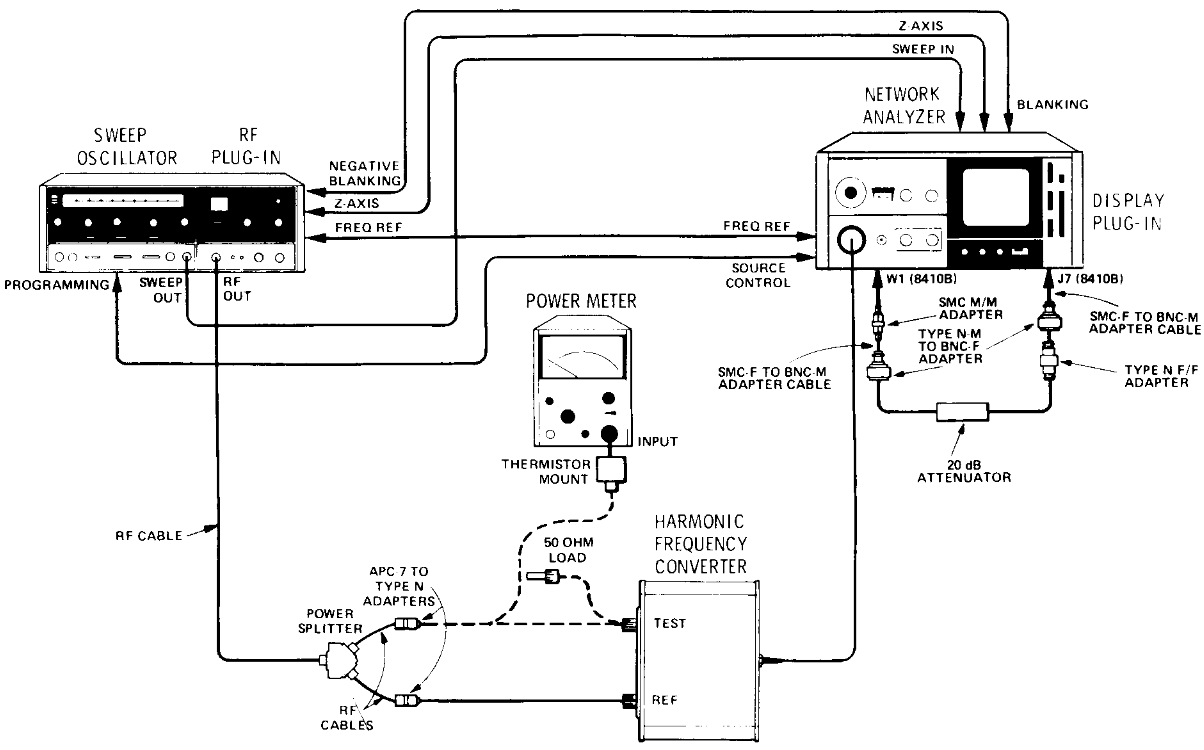
ADJUSTMENTS:

A5C13 and A5R3

DESCRIPTION:

8411A channel isolation is adjusted for >65 dB, 0.11 to 6.0 GHz; >60 dB, 6.0 to 12.4 GHz; >50 dB, 12.4 to 18 GHz (Option 018).

TEST SETUP:



TEST EQUIPMENT: Items 1, 2, 10, 14, 15, 18, 20, 23, 25, 29, 30, 31, 32, 33, Table 1-8.

PROCEDURE:

a. Remove special top and bottom test covers from 8411A and install original covers. Install covers over reference and test channel pre-amps. If test channel pre-amp cover has only one access hole, use special test cover that has five access holes for making adjustments.

b. Disconnect 8410B-W1 from J7. Insert 20 dB attenuator between W1 and J7.

c. Connect test equipment as shown in test setup with thermistor mount connected to cable from power splitter.

d. Set signal source to sweep from 6 to 12.4 GHz. Set RF output level for a −10 dBm indication on power meter.

5-22. 8411A CHANNEL ISOLATION (Cont'd)

e. Disconnect thermistor mount and connect 8411A TEST port to cable from power splitter.

f. Set 8412A MODE to AMPL, dB/DIV to 10, and BW to 0.1 kHz.

g. Set 8410B TEST CHANNEL GAIN to zero dB, FREQ RANGE to AUTO, and SWEEP STABILITY for most stable CRT display.

h. Use 8410B AMPLITUDE VERNIER control and 1 dB/step TEST CHANNEL GAIN Control (if necessary) to position CRT trace on center horizontal graticule line.

i. Disconnect 8411A TEST port from cable to power splitter and terminate TEST port with 50 ohm load.

j. Increase TEST CHANNEL GAIN by 60 dB. The CRT trace should be below the reference established in step h above.

k. If the CRT trace is below the center horizontal graticule line, no adjustment is necessary. If the CRT trace is above the center horizontal graticule line, try adjusting 8411A-A5C13. If 60 dB isolation can not be achieved try adjusting 8411A-A5R3. Note the position of A5R3 before attempting to adjust it. If adjusting it does not improve the isolation, return it to original setting. If it was necessary to readjust A5R3, the amplitude skip should be rechecked per paragraph 5-20, step p. If 60 dB isolation is not obtainable with these adjustments, repair to the sampler is required.

l. Repeat steps d through k with the signal source sweeping from 2.0 to 6.0 GHz and the TEST CHANNEL GAIN increased by 65 DB in step j.

m. For Option 018 only (12.4 to 18 GHz range). Repeat steps d through k with the signal source sweeping from 12.4 to 18 GHz and the TEST CHANNEL GAIN increased by 50 dB in step j.

5-23. 8411A AMPLITUDE AND PHASE OFFSET ADJUSTMENT

ADJUSTMENTS:

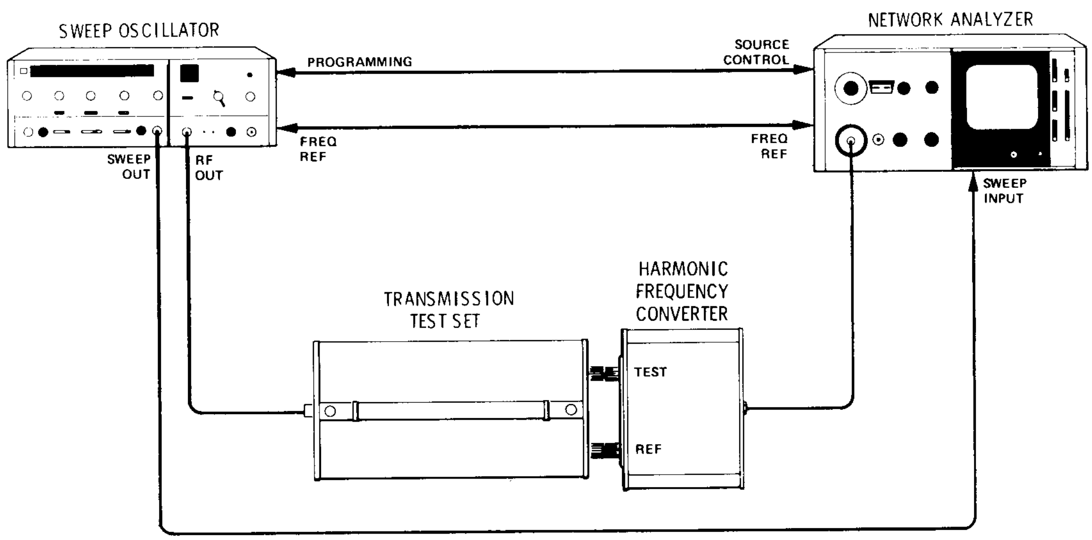
A5R20, A5R21, and select A5R8

DESCRIPTION:

The amplitude and phase offset is adjusted for center screen display with verniers centered.

5-23. 8411A AMPLITUDE AND PHASE OFFSET ADJUSTMENT (Cont'd)

TEST SETUP:



TEST EQUIPMENT: Items 1, 4, and 10, Table 1-8.

PROCEDURE:

a. Connect equipment as shown in Test Setup.

b. Set 8410B FREQ RANGE to 4 to 8 GHz.

c. Set signal source to sweep 4 to 8 GHz.

d. Adjust 8410B SWEEP STABILITY control for stable display.

e. Set 8410B TEST CHANNEL GAIN to 22 dB.

f. Center 8410B AMPLITUDE and PHASE VERNIERS.

g. Set 8412A MODE switch for DUAL display, AMPLITUDE for 1 dB/DIV, and PHASE for 10 DEG/DIV.

h. Adjust 8411A-A5R20 GAIN adjust and 8411A-A5R21 PHASE adjust to center the amplitude and phase traces on the display. See Service Hint 6. The interaction of these controls may require repeating the adjustments several times. If phase and amplitude still cannot be centered remove A5R8 and adjust for amplitude and phase zeroing with only the Phase control, A5R21.

ADJUSTMENTS

8411A SERVICE HINT 1

The interaction between the 62.5 and 65 MHz adjustment on most 8411A can be minimized by making a simple circuit modification. The modification is to the A7 VTO Assembly, part number 08411-6024 Date Code C-931-4 only. There are three versions of the A7 assembly, 08411-6002, 08411-6024 Date Code C-931-4, and 08411-6024 Date Code D-1836-45. The 08411-6002 should not be modified. The 08411-6024 Date Code D-1836-45 already contains the modification. The Part Number and date code are located on the circuit side of A7 board as shown in Figure 5-5.

Date Code C-931-4

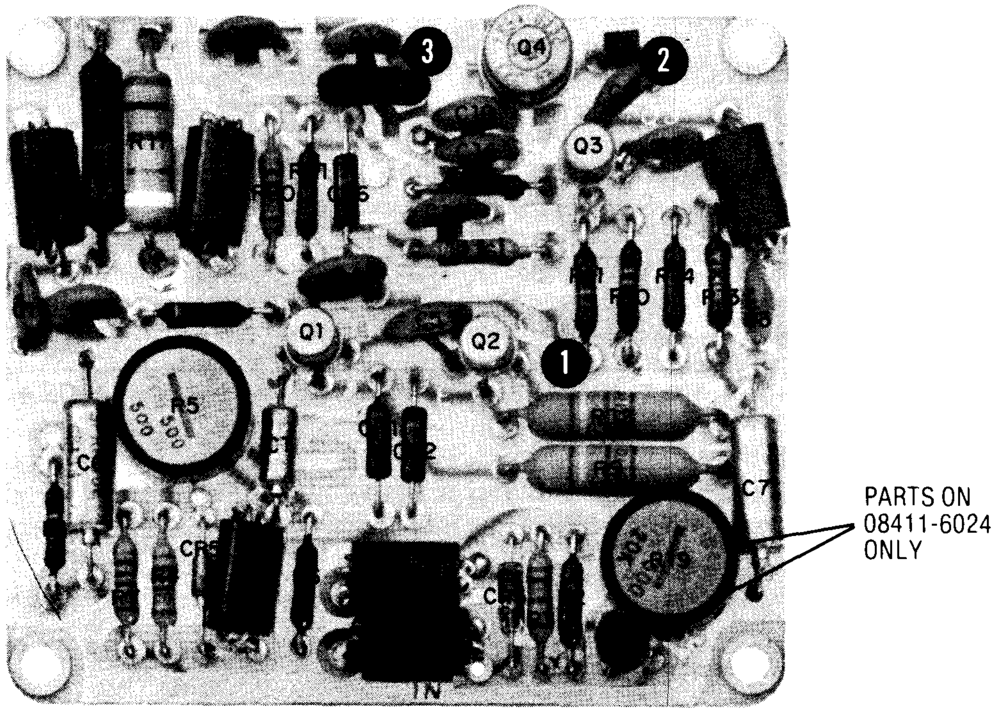


Figure 5-4. A7 VTO Assembly 08411-6024, Date Code C-931-4

MODIFICATION PROCEDURE:

1. Remove the 4 screws securing the A7 assembly to the 8411A casting.
2. Carefully tip the A7 assembly up so that the circuit side of the board is exposed.
3. Locate the printed circuit board trace that connects the base of Q5 to the wiper of R19 (see Figure 5-5). With exacto knife or razor blade cut the trace between the wiper and the end of R19. Also cut the trace from the base of Q5 to R19. Solder a jumper from the wiper of R19 to the base of Q5. See partial schematic, Figure 5-6.
4. Secure A7 assembly to the 8411A chassis.

8411A SERVICE HINT 1 (Cont'd)

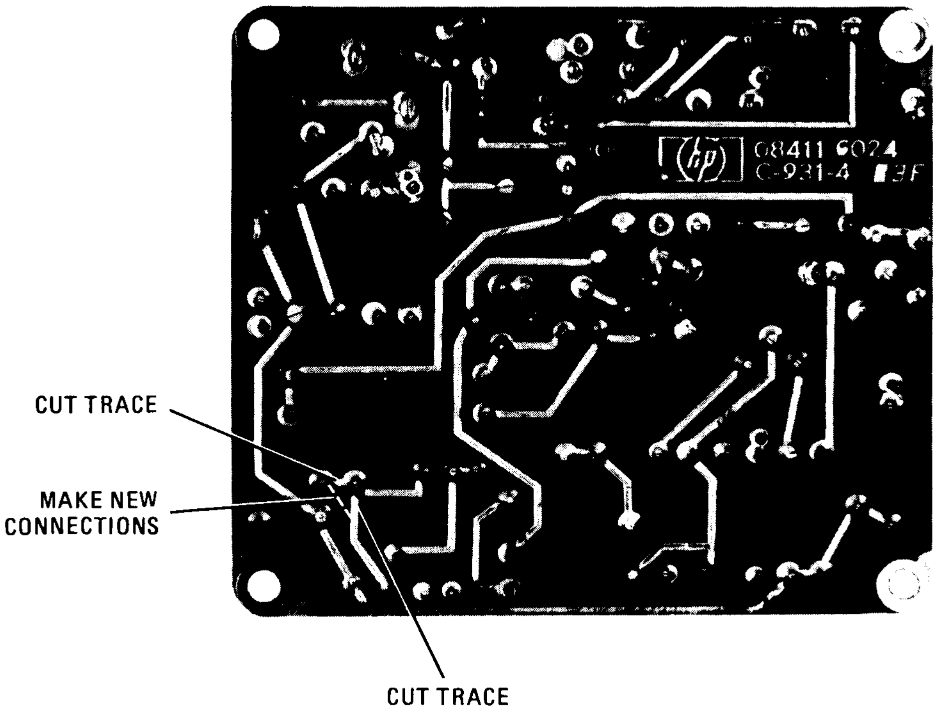


Figure 5-5. A7 08411-6024 Date Code C-931-4, Circuit Side After Modification

ADJUSTMENTS

SERVICE HINT 1 (Cont'd)

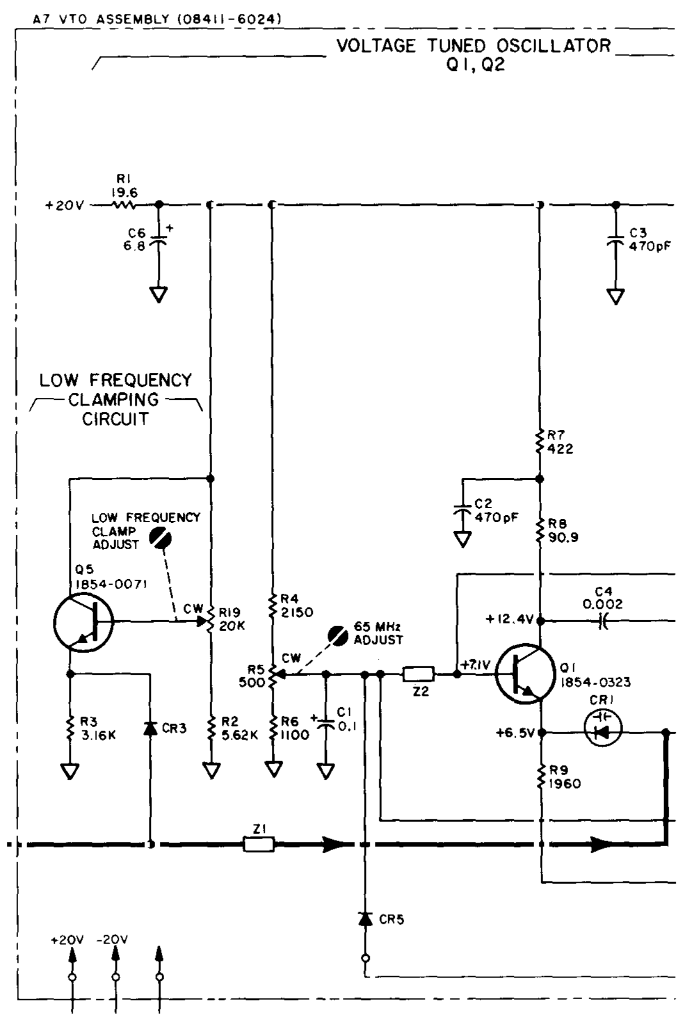


Figure 5-6. Partial Schematic of 08411-6024 Date Code C-931-4, Showing the Circuit Modification

ADJUSTMENTS

8411A SERVICE HINT 2

The Reference Channel IF gain may be changed by selecting a new value of 8411A-A4R14. Its value should not exceed 133 ohms. If A14R14 is larger than 133 ohms, the noise level will be adversely affected.

8411A SERVICE HINT 3

Frequency Jitter Over 0.11 to 2 GHz

Frequency jitter as shown in Figure 5-7 can be the result of diode bias 8411A-A4R5 not being optimized for 0.11 to 18 GHz operation. Adjusting A4R5 to completely eliminate the jitter will cause the efficiency to decrease at the high frequency end. If an adjustment of A4R5 is necessary to reduce the jitter, the efficiency should be rechecked per paragraph 5-20, steps p through r.

A power hole in the frequency range of 0.4 to 0.7 GHz is probably caused by a resonant in the sampler diode and IF amplifier. To reduce the resonant, Ferrite Beads, HP Part Number 9170-0847, can be added to the sampler diode leads. The addition of the beads will usually cause higher overall jitter but will eliminate the power hole.

Jitter can also be caused by the connection of the pulse line to the strip line. This lead should be trimmed and positioned as shown in Figure 5-8.

Another cause of jitter could be matching of the ferrite beads in the pulse line clamps. The tension on the beads is critical. First try tightening the nylon hold-down screws. If this does not improve ripple, try loosening screws. If this improves the ripple, the bead length should be shortened slightly by sanding or by selecting different beads if they are available. Frequency jitter can also be caused by the VTO transistors A7Q1 and A7Q2, HP Part No. 1854-0323. It may be necessary to try several of these transistors and choose the pair that gives minimum jitter and will oscillate over the frequency range. If the transistors are changed, it will be necessary to reset the frequency limits per paragraph 5-19 of this adjustment procedure.

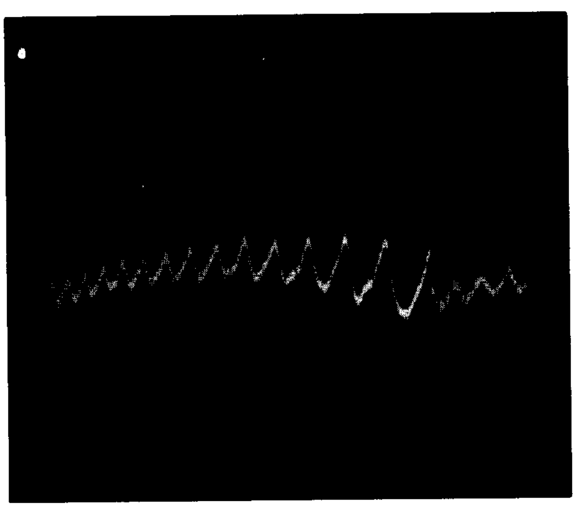


Figure 5-7. Frequency Jitter 0.11 to 2.0 GHz

ADJUSTMENTS

8411A SERVICE HINT 3 (Cont'd)

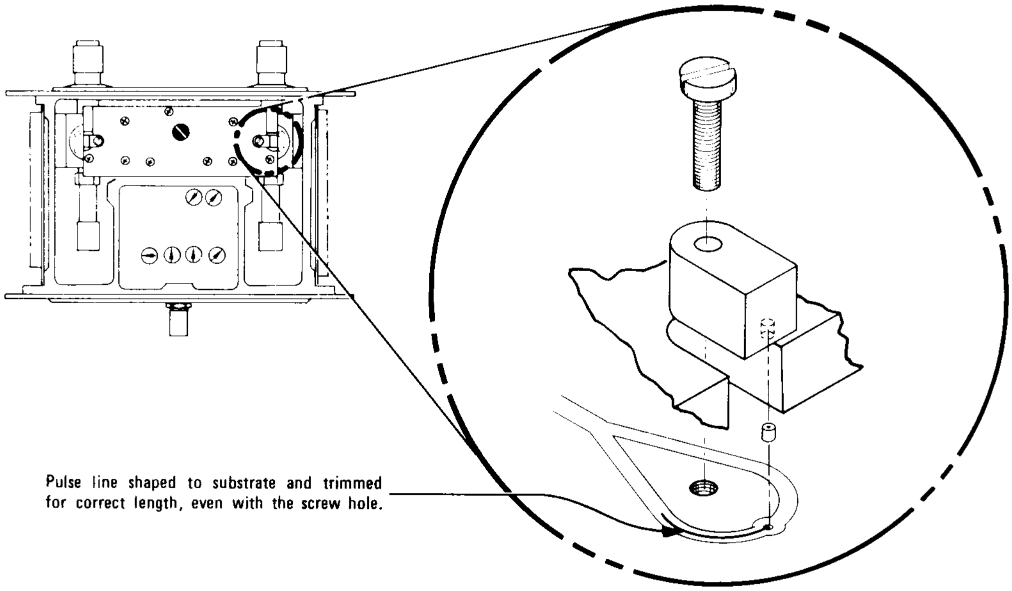


Figure 5-8. Pulse Line to Substrate Position

8411A SERVICE HINT 4

Phase Lock Loop Oscillations Eliminated By Adding Ground To A7 VTO Assembly

If VTO oscillations can not be eliminated in the frequency range of 4 to 8 GHz with A6 VTO gain shaping (Paragraph 5-21), an additional ground in A7 assembly may help.

Experiment to determine if an additional ground will reduce phase lock oscillation. Set 8410B frequency range switch to 3-6 GHz. Normally the A7 assembly is grounded to chassis by the mounting screw in the upper left corner. With a small screw driver or metal tip tuning tool, try grounding the printed circuit ground plane to each of the other mounting screws. The point that has the best results in lowering the loop oscillations should be permanently grounded. A ground terminal, HP Part Number 0360-0037, cut off, placed under the screw, then soldered to the PC board ground plane, works well.

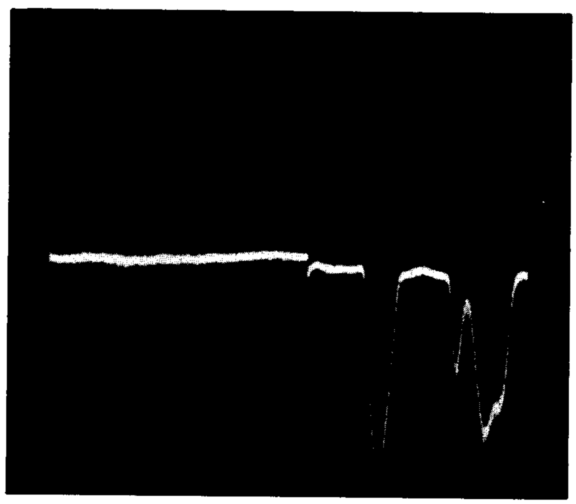


Figure 5-9. Power Holes Caused By Phase Lock Loop Oscillations

ADJUSTMENTS

8411A SERVICE HINT 5

A power hole around 10 to 18 GHz as shown in Figure 5-10 can be caused by a discontinuity in the sampler. Try reducing the temperature at the point where the load meets the body and where the front connector meets the body with cool freeze. If the discontinuity changes, the sampler must be changed.

Tracking ripple in the 2 to 12.4 GHz range (see Figure 5-11) can be caused by the sampler loads not matching. To improve matching, try substituting different loads until the tracking errors are minimized. The part number for the loads is 08410-6000.

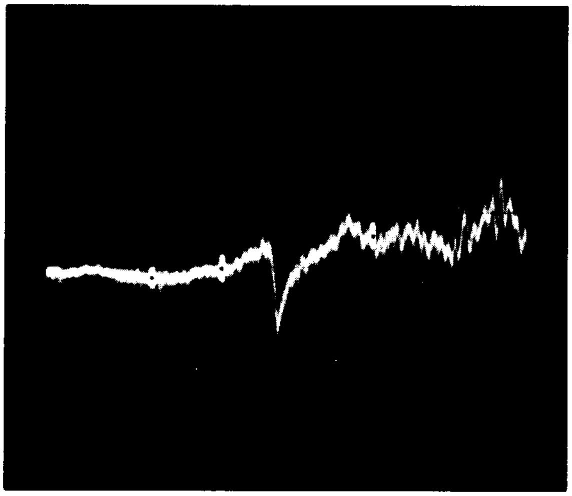


Figure 5-10. Power Hole 10 to 18 GHz Caused By Discontinuity in Sampler

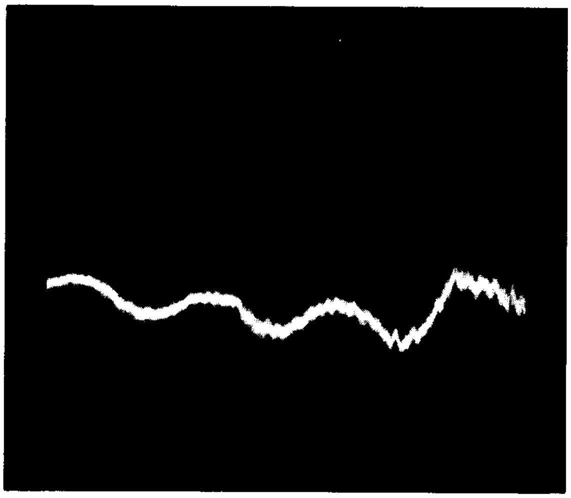


Figure 5-11. Tracking Ripple 2.0 to 12.4 GHz Caused By Sampler Loads

8411A SERVICE HINT 6

The adjustment range of the PHASE ADJ 8411A-A5R21 and GAIN ADJ 8411A-A5R20 can be increased by increasing the value of the pots by a factor of 10. See below for values and part numbers.

A5R14 RESISTOR FIXED 100 Ohm 1% 0757-0401
A5R20 RESISTOR VAR 10K 5% 2100-1776
A5R21 RESISTOR VAR 2K 5% 2100-1774

SECTION VI
REPLACEABLE PARTS

6-1. INTRODUCTION

6-2. This section contains information for ordering parts. Table 6-2 lists abbreviations used in the parts list and throughout the manual. Tables 6-3 and 6-4 lists all replaceable parts in reference designator order. Table 6-5 contains the names and addresses that correspond to the manufacturer's code numbers.

WARNING

Any service or adjustment performed with the covers removed should only be performed by qualified service personnel. A shock hazard exists with the covers removed.

6-3. EXCHANGE ASSEMBLIES

6-4. Table 6-1 lists assemblies within the instrument that may be replaced on an exchange basis, thus affording a considerable cost saving. Exchange, factory-repaired and tested assemblies are available only on a trade-in basis; therefore, the defective assemblies must be returned for credit. For this reason, assemblies required for spare parts stock must be ordered by the new assembly part number.

6-5. ABBREVIATIONS

6-6. Table 6-2 lists abbreviations used in the parts list and schematics. In some cases, two forms of the abbreviation are used, one all in capital letters, and one partial or no capitals. This occurs because the abbreviations in the parts list are always all capitals. However, in the schematics, other abbreviation forms are used with both lower case and upper case letters.

6-7. REPLACEABLE PARTS LIST

6-8. Tables 6-3 and 6-4 is the list of replaceable parts and is organized as follows:

a. Electrical assemblies and their components in alpha-numerical order by reference designation.

b. Chassis-mounted parts in alpha-numerical order by reference designation.

c. Miscellaneous parts.

6-9. The information given for each part consists of the following:

a. The Hewlett-Packard part number.

b. Part number check digit (CD)

c. The total quantity (Qty) in the major assembly (A1, A2, or A3).

d. The description of the part.

e. A typical manufacturer of the part in a five-digit code.

f. The manufacturer's number for the part.

6-10. The total quantity for each part is given only once — at the first appearance of the part number in the list for each major assembly.

NOTE

Total quantities for optional assemblies are totaled by assembly and not integrated into the standard list.

6-11. ORDERING INFORMATION

6-12. To order a part listed in the replaceable parts table, quote the Hewlett-Packard Part number (with the check digit) indicate the quantity required, and address the order to the nearest Hewlett-Packard office. The check digit will ensure accurate and timely processing of your order.

6-13. To order a part that is not listed in the replaceable parts table, include the instrument model number, instrument serial number, description and function of the part, and the number of parts required. Address the order to the nearest Hewlett-Packard office.

6-14. SPARE PARTS KIT

6-15. Stocking spare parts for an instrument is often done to ensure quick return to service after a malfunction occurs. Hewlett-Packard has a "Spare Parts Kit" available for this purpose. The kit consists of selected replaceable assemblies and components for this instrument. The contents of the kit and the "Recommended Spares" list are based on failure reports and repair data, and provides parts support for one year. A complimentary "Recommended Spares" list for this instrument may be obtained on request and the "Spare Parts Kit" may be ordered through your nearest Hewlett-Packard office.

Table 6-1. Exchange Parts

REFERENCE DESIGNATION	NEW PART NUMBER	REBUILT-EXCHANGE PART NUMBER	DESCRIPTION
STANDARD 8411A 0.11 TO 12.4 GHz			
A1 Prefix 1824A and Above	08411-80010	08411-80012	Wideband Sampler Assembly (Reference Channel)
A1 Prefix 1726A and Below	08411-80003	5080-0245	
A2 Prefix 1824A and Above	08411-80011	08411-80013	Wideband Sampler Assembly (Test Channel)
A2 Prefix 1726A and Below	08411-80004	5080-0246	
8411A OPTION 018 0.11 TO 18 GHz			
A1 Prefix 1824A and Above	08411-80005	08411-80007	Wideband Sampler Assembly (Reference Channel)
A1 Prefix 1726A and Below	08411-80102	5081-8123	
A2 Prefix 1824A and Above	08411-80006	08411-80008	Wideband Sampler Assembly (Test Channel)
A2 Prefix 1726A and Below	08422-80103	5081-8124	

NOTE

For module exchange procedure, see Paragraph 8-41.

Table 6-2. Reference Designators and Abbreviations (1 of 2)

REFERENCE DESIGNATIONS

A . . . . Assembly
AT . . . . Attenuator, Isolator, Limiter, Termination
B . . . . Fan, Motor
BT . . . . Battery
C . . . . Capacitor
CP . . . . Coupler
CR . . . . Diode, Diode Thyristor, Step Recovery Diode (SCR), ... Varactor
DC . . . . Directional Coupler
DL . . . . Delay Line
DS . . . . Annunciator, Lamp, Light Emitting Diode (LED), Signaling Device (Audible or Visible)
E . . . . Miscellaneous Electrical Part
F . . . . Fuse
FL . . . . Filter
H . . . . Hardware
HY . . . . Circulator
J . . . . . . Electrical Connector (Stationary Portion), Jack
K . . . . Relay
L . . . . Coil, Inductor
M . . . . Meter
MP . . . . Miscellaneous Mechanical Part
P . . . . . Electrical Connector (Movable Portion), Plug
Q . . . . Silicon Controlled Rectifier (SCR), Transistor, Triode Thyristor
R . . . . Resistor
RT . . . . Thermistor
S . . . . Switch
T . . . . Transformer
TB . . . . Terminal Board
TC . . . . Thermocouple
TP . . . . Test Point
U . . . . Integrated Circuit, Microcircuit
V . . . . Electron Tube
VR . . . . . . Breakdown Diode (Zener), Voltage Regulator
W . . . . . Cable, Transmission Path, Wire
X . . . . Socket
Y . . . . Crystal Unit (Piezoelectric, Quartz)
Z . . . . . Tuned Cavity, Tuned Circuit

ABBREVIATIONS

A

ABS . . . . Absolute, Acrylonitrile Butadiene Styrene
A/D . . . . Analog-to-Digital
ADJ . . Adjust, Adjustment
AG . . . . Silver
AGC . . . . . Automatic Gain Control
AL . . . . Aluminum
ALTNG . . . . . . Alternating
ANDZ . . . . Anodized
APC . . . . Automatic Phase Control
ASSY . . . . Assembly
AT . . . . Ampere Turn
ATTEN . . . . . Attenuation, Attenuator
AWG . . . . American Wire Gage

B

BDG . . . . Binding
BH . . . . Binding Head
BLK . . Black, Blank, Block
BNC . . . Type of Connector
BRS . . . . Brass

C

C . . . . Capacitance, Capacitor, Center Tapped, Centistoke, Cermet, Circular Mil Foot, Closed Cup, Cold, Compression
CCP . . . . Carbon Composition Plastic
CER . . . . Ceramic
CMOS . . . Complementary Metal Oxide Semiconductor
CNDCT . . . . . Conducting, Conductive, Conductivity, Conductor
COAX . . . . Coaxial
CONN . . . . Connect, Connection, Connector
CONT . . . . Contact, Continuous, Control, Controller
CTR . . . . Center

D

D. Deep, Depletion, Depth, Diameter, Direct Current
DB . . . . . . Decibel, Double Break
DC . . . . Direct Current, Double Contact
DEG . . . . Degree
DIO . . . . Diode
D-MODE . . . . . . Depletion Mode
DO . . . . Package Type Designation
DPDT . . . . . . Double Pole Double Throw
DR . . Dram, Drill, Drilled, Drive, Drum

E

ELEC . . . . Electrical, Electronic
ELECT . . . . . . Electrolytic
EXT . . . . Extended, Extension, External, Extinguish

F

F . . . . . Fahrenheit, Farad, Female, Film (Resistor), Fixed, Flange, Flint, Fluorine, Frequency
FDTHRU . . Feed Through
FEM . . . . Female
FET . . . . Field-Effect Transistor
FH . . Flat Head, Full Hard
FIG . . . . Figure
FIL . . . . . . Filament, Fillet, Fillister
FL . . . . . Flash, Flat, Fluid
FLM . . . . Film, Flame
FM . . . . Flange, Male Connection; Foam, Frequency Modulation
FR . . . . Folder
FREQ . . . . Frequency
FT . . . . Current Gain Bandwidth Product (Transition Frequency); Feet, Foot
FXD . . . . Fixed

G

GA . . . . . Gallium, Gallon, Gauge
GE . . . . Germanium
GMV . . . . Guaranteed Minimum Value
GP . . . . . General Purpose, Group
GRA . . . . Gray

Table 6-2. Reference Designators and Abbreviations (2 of 2)

H

HD . . . Hand, Hard, Head, Heavy Duty
HEX . . . . . . Hexadecimal, Hexagon, Hexagonal
HLCL . . . . Helical
HV . . . . High Voltage
HZ . . . . Hertz

I

IC . . . . . Collector Current, Integrated Circuit
ID . . . . Inside Diameter
IF . . . . . . Forward Current, Intermediate Frequency
IN . . . . Inch, Indium
INCL . . . . Including
INS . . . . Insert, Inside, Insulation, Insulator
INT . . . Integral, Intensity, Internal
INTL . . . . Internal, International
IV . . . . Insulation Voltage, Valley Point (Emitter) Current

J

J . . . . Jack, Joule, Junction
J-FET . . . . . Junction Field Effect Transistor
JKT . . . . Jacket

K

K . . . . . . Kelvin, Key, Kilo, Potassium
KHZ . . . . Kilohertz
KV . . . . Kilovolt

L

L . . . . . . Inductance, Left, Length, Liquid, Lock-ing Threaded, Long, Low
LG . . . . Length, Long
LIN . Linear, Linear Taper, Linearity
LITE . . . . Light
LKWR . . . . . . Lockwasher
LRD . . . . Legend Red (HP 6009-0035)
LT . . . . . Left, Light, Liter

M

M . . . . . . Male, Maximum, Mega, Mil, Milli, Mode, Momentary, Mounting Hole Centers, Mounting Hole Diameter
MA . . . . Milliampere
MACH . . . . Machined
MET . . . . . Metal, Metallic, Metallized, Metallurgical
MET OX . . . . Metal Oxide
MH . . . . Medium High
MHZ . . . . Megahertz
MLD . . . . . . Mold, Molded
MO . . . . Metal Oxide, Milliounce, Molybdenum
MOD . . . Model, Modified, Modular, Modulated, Modulator
MOSFET . . . . Metal Oxide Semiconductor Field Effect Transistor
MTG . . . . Mounting
MW . . . . Milliwatt
MY . . . . . Polyester (Mylar)

N

NAND . . . Logic Not-AND
N-CHAN . . . . . N-Channel
NH . . . . Nanohenry
NM . . . . Nanometer, Nonmetallic
NO . . . . . . Normally Open, Number
NOM . . . . Nominal
NOR . . . . . . Logic Not-OR
NP . . . . Nickel Plated
NPN . . . . Negative Positive Negative (Transistor)
NPO . . . . Negative Positive Zero (Zero Temperature Coefficient)
NS . . . . Nanosecond, Non-Shorting, Nose
NSR . . . . . . Not Separately Replaceable

O

OD . . . Olive Drab, Outside Diameter
OPT . . . . Optical, Option, Optional
OX . . . . Oxide

P

P. Peak, Phosphorus, Pico, Picosecond, Pitch, Plug, Pole, Polyester, Power, Probe, Pure
PB . . . . Lead (Metal), Push Button
P.C . . . . Printed Circuit
PC . . . Picocoulomb, Piece, Printed Circuit
P-CHAN . . . . . P-Channel
PD . Pad, Palladium, Pitch Diameter, Power Dissipation
PF . . . . . . Picofarad; Pipe, Female Connection; Power Factor
PHEN . Bakelite (Phenolic)
PHL . . . . Phillips
PIN . . . . . Positive Intrinsic Negative (Transistor)
PIV . . . Peak Input Voltage
PL . . . . Phase Lock, Plain, Plate, Plug
PNP . . . . Positive Negative Positive (Transistor)
POLYE . . . . Polyester
POZI . . . . . Pozidriv Recess
PRCN . . . . Precision
PRI . . . . Primary
PRP . . . . . Purple, Purpose
PS . . . . Picosecond, Poise, Polystyrene, Positive Shorting, Pressure Sensitive
PTS . . . . Parts
PWW . . . . Precision Wirewound

Q

Q . . . . Figure of Merit
QUAD . . . . Set of Four

R

R . Range, Red, Resistance, Resistor, Right, Ring, Rosin, Rubber-Resin, Run Torque
RD . . Dynamic Resistance, Round
RECT . . . . Rectangle, Rectangular, Rectifier
REF . . . . Reference
RF . . . . . . Radio Frequency
RFI . . . . . Radio Frequency Interference
RG . . . . . Source Resistance
RMS . . . Root Mean Square
RTNR . . . . Retainer

S

SEC . . . Second, Secondary
SGL . . . . Single
SHFT . . . . Shaft
SI . . . . Silicon, Square Inch
SL . . . . Slide, Slow
SLDR . . . . Solder
SLT . . . Slate, Slot, Slotted
SMC . . . . Subminiature, C Type (Threaded Connector)
SPCG . . . . Spacing
SST . . . . Stainless Steel
ST . . . . Set
STD . . . . Standard
STDOFF . . . . Standoff
STL . . . . Steel
SUBMIN . . . Subminiature
SW . . . Single Wall, Switch

T

T . . . . . Tab Width, Taper, Teeth, Temperature, Tera, Tesla, Thermoplastic (Insulation), Thickness, Time, Timed, Tooth, Turns Ratio, Typical
TA . . . . Ambient Temperature, Tantalum
TANT . . . . Tantalum
TC . . . . Thermoplastic
TERM . . . . Terminal, Termination
THD . . . Thread, Threaded
THK . . . . Thick
THRU . . . . Through
TRMR . . . . Trimmer
TRN . . . . Turn, Turns
TSTR . . . . Transistor
TUR . . . . Turret

U

U . . . . . . Micro, Untapped, Uranium
UF . . . . Microfarad
UH . . . . Microhenry
UNMTD . . . . . Unmounted
US . . . . Microsecond, Microsiemen

V

V . . . . Vanadium, Variable, Violet, Volt, Voltage
VAR . . . . Variable
VDC . Volts, Direct Current
VDCW . . . . . Direct Curent Working Volts
VTO . . . . . . Voltage Tuned Oscillator

W

W . . Watt, Wattage, White, Wide, Width, Wire
W/ . . . . With
WIV . . . . Working Inverse Voltage
WV . . . . . Working Voltage
WVAC . Working Voltage, Alternating Current
WW . . . . Wire Wound

Z

ZMAX . . . . Maximum Impedance
ZNR . . . . Zener

Table 6-3. 8410B Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1	08410-6013	5	1	ASSEMBLY, FREQUENCY RANGE SWITCH	28480	08410-6013
A1R1	0757-0290	5	3	RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A1R2	0757-0438	3	11	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A1R3	0757-0279	0	7	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A1R4	0698-3150	6	2	RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A1R5	0757-0428	1	3	RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A1R6	0757-0274	5	2	RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A1R7	0757-0420	3	1	RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A1R8	0757-0418	9	2	RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A1R9	0698-3447	4	1	RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A1R10	0698-3444	1	4	RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A1R11	0757-0402	1	3	RESISTOR 110 1% .125W F TC=0+-100	24546	C4-1/8-T0-111-F
A1R12	0698-4037	0	1	RESISTOR 46.4 1% .125W F TC=0+-100	24546	C4-1/8-T0-46R4-F
A1R13	0757-0346	2	1	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A1R14	0757-0397	3	1	RESISTOR 68.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-68R1-F
A1R15	0757-0399	5		RESISTOR 82.5 1% .125W F TC=0+-100	24546	C4-1/8-T0-82R5-F
A1R16	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A1R17	0698-3437	2	1	RESISTOR 133 1% .125W F TC=0+-100	24546	C4-1/8-T0-133R-F
A1R18	0757-0405	4	1	RESISTOR 162 1% .125W F TC=0+-100	24546	C4-1/8-T0-162R-F
A1R19	0698-3441	8	1	RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A1R20	0698-3443	0	4	RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A1R21	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A1R22	0757-0416	7	6	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A1R23	0757-0419	0	2	RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A1R24	0757-0274	5		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A1R25	0757-0278	9	3	RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A1R26	0698-3153	9	4	RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A1R27	2100-3427	7	1	RESISTOR-VAR W/SW 20K 20% LIN SPDT-NC-NO	28480	2100-3427
A1R28	0757-0467	8	1	RESISTOR 121K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A1S1	3100-2015	8	1	SWITCH-RTRY DP13T-PS 1.562-CTR-SPCG	28480	3100-2015
A2	08410-6014	7	1	ASSEMBLY, ATTENUATOR 0-9 DB	28480	08410-6014
	08410-0006	4	2	COVER, ATTENUATOR	28480	08410-0006
	08410-0019	1	2	CLAMP/PLATE ATTENUATOR COVER	28480	08410-0019
	08410-6027	4	1	CABLE ASSEMBLY, AMPLIFIER VERNIER	28480	08410-6027
A2R1	0811-1773	7	2	RESISTOR 238.484 .1% .05W PWW TC=0+-20	20940	140-1/40-238R484-B
A2R2	0811-1778	2	4	RESISTOR 2.20971K .1% .05W PWW TC=0+-20	20940	140-1/40-2209R71-B
A2R3	0811-1778	2		RESISTOR 2.20971K .1% .05W PWW TC=0+-20	20940	140-1/40-2209R71-B
A2R4	0811-1773	7		RESISTOR 238.484 .1% .05W PWW TC=0+-20	20940	140-1/40-238R484-B
A2R5	0811-1778	2		RESISTOR 2.20971K .1% .05W PWW TC=0+-20	20940	140-1/40-2209R71-B
A2R6	0811-1778	2		RESISTOR 2.20971K .1% .05W PWW TC=0+-20	20940	140-1/40-2209R71-B
A2R7	0811-1772	6	2	RESISTOR 116.149 .1% .05W PWW TC=0+-20	20940	140-1/40-116R149-B
A2R8	0811-1781	7	4	RESISTOR 4.36212K .1% .05W PWW TC=0+-20	20940	140-1/40-4362R12-B
A2R9	0811-1781	7		RESISTOR 4.36212K .1% .05W PWW TC=0+-20	20940	140-1/40-4362R12-B
A2R10	0811-1772	6		RESISTOR 116.149 .1% .05W PWW TC=0+-20	20940	140-1/40-116R149-B
A2R11	0811-1781	7		RESISTOR 4.36212K .1% .05W PWW TC=0+-20	20940	140-1/40-4362R12-B
A2R12	0811-1781	7		RESISTOR 4.36212K .1% .05W PWW TC=0+-20	20940	140-1/40-4362R12-B
A2R13	0811-1771	5	1	RESISTOR 57.69 .1% .05W PWW TC=0+-20	20940	140-1/40-57R69-B
A2R14	0811-1782	8	2	RESISTOR 8.69548K .1% .05W PWW TC=0+-20	20940	140-1/40-8695R48
A2R15	0811-1782	8		RESISTOR 8.69548K .1% .05W PWW TC=0+-20	20940	140-1/40-8695R48
A2S1	3100-2014	7	1	SWITCH-ROTARY 1.250 STRUT CTR SPCG; 10	28480	3100-2014
A3	08410-6015	9	1	ASSEMBLY, 0-60 DB	28480	08410-6015
	08410-0006	4		COVER, ATTENUATOR	28480	08410-0006
	08410-0019	1		CLAMP/PLATE ATTENUATOR COVER	28480	08410-0019
A3C1	0160-2204	0	3	CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A3L1	9100-1660	3	1	COIL-MLD 2MH 5% Q=65 .215DX.56LG-NOM	28480	9100-1660
A3R1	0811-1779	3	3	RESISTOR 2.475K .1% .05W PWW TC=0+-20	20940	140-1/40-2475R-B
A3R2	0811-1775	9	6	RESISTOR 611.111 .1% .05W PWW TC=0+-20	20940	140-1/40-611R111-B
A3R3	0811-1775	9		RESISTOR 611.111 .1% .05W PWW TC=0+-20	20940	140-1/40-611R111-B
A3R4	0811-1776	0	3	RESISTOR 711.51 .1% .05W PWW TC=0+-20	20940	140-1/40-711R510-B
A3R5	0811-1777	1	6	RESISTOR 962.475 .1% .05W PWW TC=0+-20	28480	0811-1777
A3R6	0811-1777	1		RESISTOR 962.475 .1% .05W PWW TC=0+-20	28480	0811-1777
A3R7	0811-1779	3		RESISTOR 2.475K .1% .05W PWW TC=0+-20	20940	140-1/40-2475R-B
A3R8	0811-1775	9		RESISTOR 611.111 .1% .05W PWW TC=0+-20	20940	140-1/40-611R111-B
A3R9	0811-1775	9		RESISTOR 611.111 .1% .05W PWW TC=0+-20	20940	140-1/40-611R111-B
A3R10	0811-1776	0		RESISTOR 711.51 .1% .05W PWW TC=0+-20	20940	140-1/40-711R510-B
A3R11	0811-1777	1		RESISTOR 962.475 .1% .05W PWW TC=0+-20	28480	0811-1777
A3R12	0811-1777	1		RESISTOR 962.475 .1% .05W PWW TC=0+-20	28480	0811-1777
A3R13	0811-1779	3		RESISTOR 2.475K .1% .05W PWW TC=0+-20	20940	140-1/40-2475R-B
A3R14	0811-1775	9		RESISTOR 611.111 .1% .05W PWW TC=0+-20	20940	140-1/40-611R111-B
A3R15	0811-1775	9		RESISTOR 611.111 .1% .05W PWW TC=0+-20	20940	140-1/40-611R111-B

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. 8410B Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A3R16	0811-1776	0		RESISTOR 711.51 .1% .05W PWW TC=0+-20	20940	140-1/40-711R510-B
A3R17	0811-1777	1		RESISTOR 962.475 .1% .05W PWW TC=0+-20	28480	0811-1777
A3R18	0811-1777	1		RESISTOR 962.475 .1% .05W PWW TC=0+-20	28480	0811-1777
A3R19	0811-1774	8	1	RESISTOR 500 .1% .05W PWW TC=0+-20	20940	140-1/40-501-B
A3S1	3100-2006	7	1	SWITCH-ROTARY 1.250 STRUT CTR SPCG; 7	28480	3100-2006
A4	08410-6003	4	1	ASSEMBLY, 20 MHZ IF AMPLIFIER BOARD	28480	08410-6003
A4C1	0160-2055	9	29	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4C2	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4C3	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4C4	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4C5	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4C6	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4C7	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4C8	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4C9	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4C10	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4C11	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4C12	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4C13	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4C14	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4Q1	1854-0073	9	9	TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0073
A4Q2	1854-0073	9		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0073
A4Q3	1853-0034	0	3	TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
A4Q4	1854-0073	9		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0073
A4Q5	1853-0034	0		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
A4Q6	1854-0073	9		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0073
A4R1	0757-0442	9	5	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4R2	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A4R3	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A4R4	0757-0280	3	6	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4R5	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A4R6	0698-0083	8	8	RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A4R7	0698-0085	0	1	RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F
A4R8	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A4R9	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A4R10	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A4R11	0698-3132	4	1	RESISTOR 261 1% .125W F TC=0+-100	24546	C4-1/8-T0-2610-F
A4R12	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A4R13	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A4R14	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A4R15	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A4R16	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4R17	0757-0418	9		RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A4R18	0757-0422	5	2	RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A4R19	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A4R20	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A4R21	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A4R22	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A4R23	0698-3156	2	3	RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A4R24	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A4R25	0698-3440	7	6	RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A4R26	0698-3446	3	3	RESISTOR 383 1% .125W F TC=0+-100	24546	C4-1/8-T0-383R-F
A4R27	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A4R28	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A4R29	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A4R30	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A5	08410-6037	5	1	ASSEMBLY, PHASE DETECTOR BOARD	28480	08410-6037
A5C1				DELETED		
A5C2	0160-2255	1	1	CAPACITOR-FXD 8.2PF +-.25PF 500VDC CER	28480	0160-2255
A5C3	0140-0191	8	1	CAPACITOR-FXD 56PF +-5% 300VDC MICA	72136	DM15E560J0300WV1CR
A5C4	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C5	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C6	0160-0370	7	1	CAPACITOR-FXD 20PF +-5% 500VDC MICA	28480	0160-0370
A5C7	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C8	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C9	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C10	0160-2307	4	4	CAPACITOR-FXD 47PF +-5% 300VDC MICA	28480	0160-2307
A5C11	0160-2307	4		CAPACITOR-FXD 47PF +-5% 300VDC MICA	28480	0160-2307
A5C12	0160-2307	4		CAPACITOR-FXD 47PF +-5% 300VDC MICA	28480	0160-2307
A5C13	0160-2307	4		CAPACITOR-FXD 47PF +-5% 300VDC MICA	28480	0160-2307
A5C14	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C15	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. 8410B Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A5C16	0160-0155	6	1	CAPACITOR-FXD 3300PF +-10% 200VDC POLYE	28480	0160-0155
A5C17				DELETED		
A5CR1	1901-0179	7	8	DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A5CR2	1901-0179	7		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A5CR3	1901-0179	7		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A5CR4	1901-0179	7		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A5CR5	1901-0179	7		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A5CR6	1901-0179	7		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A5CR7	1901-0179	7		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A5CR8	1901-0179	7		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A5CR9	1901-0022	9	2	DIODE-STABISTOR 10V 250MA	28480	1901-0022
A5CR10	1901-0022	9		DIODE-STABISTOR 10V 250MA	28480	1901-0022
A5L1				DELETED		
A5L2	9140-0105	3	1	COIL-MLD 8.2UH 10% Q=50 .155DX.375LG-NOM	28480	9140-0105
A5L3	9100-1614	7	1	COIL-MLD 820NH 10% Q=50 .155DX.375LG-NOM	28480	9100-1614
A5L4	9140-0121	3	1	COIL-MLD 1.8UH 10% Q=33 .155DX.375LG-NOM	28480	9140-0121
A5L5				DELETED		
A5Q1	1854-0071	7	12	TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A5Q2	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A5Q3	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A5Q4	1854-0073	9		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0073
A5Q5	1854-0073	9		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0073
A5Q6	1854-0073	9		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0073
A5R1	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A5R2	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A5R3*	0698-3157	3	2	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A5R4	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A5R5	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A5R6*	0698-3157	3	2	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A5R7	0757-0421	4	2	RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A5R8	0757-0199	3	6	RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A5R9	0757-0199	3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A5R10	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A5R11	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A5R12	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A5R13	0698-3438	3	3	RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A5R14	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A5R15	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A5R16	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A5R17	0698-3443	0		RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A5R18	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A5R19	0698-3443	0		RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A5R20	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A5R21	0698-3155	1	2	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A5R22	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A5R23	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A5R24	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A5R25	0698-3154	0	5	RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A5R26	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A5R27	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A5R28	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A5R29	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A5R30	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A6	08410-6009	6	1	20 MHZ OSCILLATOR ASSEMBLY DOES NOT INCLUDE Y1	28480	08410-6009
A6C1	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C2	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C3	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C4	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C5	0140-0199	6	1	CAPACITOR-FXD 240PF +-5% 300VDC MICA	72136	DM15F241J0300WV1CR
A6C6*						
A6C7	0160-2218	6	1	CAPACITOR-FXD 1000PF +-5% 300VDC MICA	28480	0160-2218
A6C8	0140-0205	5	1	CAPACITOR-FXD 62PF +-5% 300VDC MICA	72136	DM15E620J0300WV1CR
A6C9	0160-2204	0		CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A6C10	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C11	0160-2204	0		CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A6C12	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C13	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C14	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6CR1	1910-0022	8	2	DIODE-GE 5V 60MA 3.5NS DO-7	28480	1910-0022
A6CR2	1910-0022	8		DIODE-GE 5V 60MA 3.5NS DO-7	28480	1910-0022

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. 8410B Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6L1	9100-1631	8	1	COIL-MLD 56UH 5% Q=55 .155DX.375LG-NOM	28480	9100-1631
A6Q1	1854-0073	9		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0073
A6Q2	1854-0073	9		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0073
A6Q3	1853-0034	0		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
A6R1	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A6R2	0757-0447	4	3	RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A6R3	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A6R4	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A6R5	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A6R6	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A6R7	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A6R8	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A6R9	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R10	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A6R11	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A6R12	0757-0422	5		RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A6R13	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A6R14	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A6R15	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A6R16	0698-3150	6		RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A6R17	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A6R18	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A6R19	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A6XY1	1200-0191	7	1	SOCKET-XTAL 2-CONT HC-25/U DIP-SLDR	28480	1200-0191
A6Y1	0410-0123	9	1	CRYSTAL, QUARTZ(MATCHED TO A13Y1)	28480	0410-0123
A7	08410-6041	4	1	ASSEMBLY, VTO-DC AMPLIFIER BOARD	28480	08410-6041
A7C1	0160-2230	2	1	CAPACITOR-FXD 3300PF +-5% 300VDC MICA	28480	0160-2230
A7C2	0180-0100	3	1	CAPACITOR-FXD 4.7UF+-10% 35VDC TA	56289	150D475X9035B2
A7C3	0160-2209	5	1	CAPACITOR-FXD 360PF +-5% 300VDC MICA	28480	0160-2209
A7C4	0180-0374	3	1	CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A7C5	0150-0121	5	3	CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A7C6	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A7C7	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A7C8	0160-0159	0	1	CAPACITOR-FXD 6800PF +-10% 200VDC POLYE	28480	0160-0159
A7C9	0160-0167	0	1	CAPACITOR-FXD .082UF +-10% 200VDC POLYE	28480	0160-0167
A7C10	0160-0160	3	1	CAPACITOR-FXD 8200PF +-10% 200VDC POLYE	28480	0160-0160
A7CR1	1901-0025	2	2	DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A7CR2	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A7Q1	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A7Q2	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A7Q3	1853-0020	4	8	TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A7Q4	1855-0078	6	1	TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0078
A7Q5	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A7Q6	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A7Q7	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A7Q8	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A7R1	0698-3260	9	1	RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A7R2	0757-0461	2	1	RESISTOR 68.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6812-F
A7R3	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A7R4	0698-3451	0	1	RESISTOR 133K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1333-F
A7R5	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A7R6	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A7R7	0757-0276	7	1	RESISTOR 61.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A7R8	0757-0458	7	2	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A7R9	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A7R10	2100-3354	9	1	RESISTOR-TRMR 50K 10% C SIDE-ADJ 1-TRN	28480	2100-3354
A7R11	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A7R12	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A7R13	0757-0288	1	1	RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A7R14	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A7R15	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A7R16	0698-3450	9	2	RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A7R17	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A7R18	0757-0463	4	1	RESISTOR 82.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8252-F
A7R19	0757-0462	3	1	RESISTOR 75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7502-F
A7R20	0757-0447	4		RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A7R21	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A7R22	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A7R23	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A7R24	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A7R25	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. 8410B Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A7R26	0757-0419	0		RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A7R27	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A7R28	0698-0082	7	1	RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A8	08410-6007	2	1	SEARCH GENERATOR ASSEMBLY	28480	08410-6007
A8C1	0160-0168	1	1	CAPACITOR-FXD .1UF +-10% 200VDC POLYE	28480	0160-0168
A8Q1	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8Q2	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8Q3	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A8Q4	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A8Q5	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A8Q6	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8Q7	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A8Q8	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A8Q9	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A8Q10	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A8R1	0757-0417	8	2	RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F
A8R2*	0757-0399	5	2	RESISTOR 82.5 1% .125W F TC=0+-100	24546	C4-1/8-T0-82R5-F
A8R3	0757-0428	1		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A8R4	0757-0402	1		RESISTOR 110 1% .125W F TC=0+-100	24546	C4-1/8-T0-111-F
A8R5	0698-3446	3		RESISTOR 383 1% .125W F TC=0+-100	24546	C4-1/8-T0-383R-F
A8R6	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A8R7	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A8R8	0757-0424	7	2	RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
A8R9				NOT ASSIGNED		
A8R10				NOT ASSIGNED		
A8R11	0757-0200	7	1	RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A8R12	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A8R13	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A8R14	0757-0424	7		RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
A8R15	0757-0443	0	1	RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A8R16	0698-3151	7	1	RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2871-F
A8R17	0698-3443	0		RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A8R18	0757-0278	9		RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A8R19	0757-0441	8	1	RESISTOR 8.25K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8251-F
A8R20	0757-0199	3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A8R21	0757-0199	3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A8R22	0757-0199	3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A8R23	0757-0199	3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A8R24	0757-0290	5		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A8R25	0757-0290	5		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A8R26	0757-0458	7		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A8R27	0698-3159	5	2	RESISTOR 26.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2612-F
A8R28	0698-3159	5		RESISTOR 26.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2612-F
A8R29				NOT ASSIGNED		
A8R30	0757-0278	9		RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A8R31				NOT ASSIGNED		
A8R32	0698-3136	8	1	RESISTOR 17.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1782-F
A8R33	0698-3450	9		RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A8R34	0757-0447	4		RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A8R35	0698-3446	3		RESISTOR 383 1% .125W F TC=0+-100	24546	C4-1/8-T0-383R-F
A8R36	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A8R37	0757-0402	1		RESISTOR 110 1% .125W F TC=0+-100	24546	C4-1/8-T0-111-F
A8R38	0757-0428	1		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A8R39*	0757-0401	0	20	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A8R40	0757-0417	8		RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. 8410B Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A9	08410-60106	1	1	BOARD ASSEMBLY, AUTOMATIC CONTROL	28480	08410-60106
A9C1	0160-0575	4	2	CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A9C2	0160-3877	5	1	CAPACITOR-FXD 100PF +-20% 200VDC CER	28480	0160-3877
A9C3	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A9C4	0160-0571	0	1	CAPACITOR-FXD 470PF +-20% 100VDC CER	28480	0160-0571
A9C5	0180-1745	4	1	CAPACITOR-FXD 1.5UF+-10% 20VDC TA	56289	150D155X9020A2
A9C6	0180-1743	2	2	CAPACITOR-FXD .1UF+-10% 35VDC TA	56289	150D104X9035A2
A9C7	0180-1743	2		CAPACITOR-FXD .1UF+-10% 35VDC TA	56289	150D104X9035A2
A9C8	0160-4084	8	2	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A9C9	0180-1746	5	1	CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A9C10	0160-4084	8		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A9CR1	1901-0040	1	2	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A9CR2	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A9Q1	1854-0071	7	9	TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A9Q2	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A9Q3	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A9Q4	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A9Q5	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A9Q6	1855-0020	8	1	TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A9Q7	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A9Q8	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A9Q9	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A9Q10	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A9R1	0757-0465	6	1	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A9R2	0757-0461	2	1	RESISTOR 68.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6812-F
A9R3	0757-0442	9	3	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A9R4	0683-1055	5	1	RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A9R5	0757-0458	7	4	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A9R6	0757-0458	7		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A9R7	0757-0458	7		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A9R8	0698-3162	0	1	RESISTOR 46.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4642-F
A9R9	2100-3109	2	1	RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	02111	43P202
A9R10	0757-0290	5	1	RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A9R11	0757-0428	1	2	RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A9R12	0757-0421	4	1	RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A9R13	0757-0416	7	2	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A9R14	0757-0458	7		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A9R15	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A9R16	0757-0420	3	1	RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A9R17	2100-3094	4	1	RESISTOR-TRMR 100K 10% C SIDE-ADJ 17-TRN	02111	43P104
A9R18	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A9R19*	0698-3158	4	2	RESISTOR 23.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2372-F
A9R20*	0757-0444	1	1	RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A9R21*	0757-0123	3	1	RESISTOR 34.8K 1% .125W F TC=0+-100	28480	0757-0123
A9R22	0698-0083	8	2	RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A9R23	0698-3156	2	2	RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A9R24	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A9R25	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A9R26	0698-3155	1	1	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A9R27	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A9R28	0698-3158	4		RESISTOR 23.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2372-F
A9R29	0757-0440	7	1	RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A9R30	0698-3153	9	1	RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A9R31	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A9R32	0757-0438	3	1	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A9R33	0698-3446	3	1	RESISTOR 383 1% .125W F TC=0+-100	24546	C4-1/8-T0-383R-F
A9R34	0698-3443	0	1	RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A9R35	0757-0428	1		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A9R36	0698-3260	9	1	RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A9U1	1820-1538	2	1	IC GATE CMOS NAND QUAD 2-INP	01928	CD4011AF
A9U2	1820-2051	6	2		28480	1820-2051
A9U3	1820-2051	6			28480	1820-2051
A9U4	1826-0026	3	1	COMPARATOR PRCN TO-99	04713	MLM311G
A9VR1	1902-0680	7	1	DIODE-ZNR 1N827 6.2V 5% DO-7 PD=.25W	24046	1N827
A9VR2	1902-0071	0	1	DIODE-ZNR 9V 5% DO-14 PD=.5W TC=+.001%	28480	1902-0071
A9VR3	1902-0025	4	1	DIODE-ZNR 10V 5% DO-7 PD=.4W TC=+.06%	28480	1902-0025
A9XU1	1200-0508	0	1	SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0508
A9XU2	1200-0507	9	2	SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0507
A9XU3	1200-0507	9		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0507
A9XU4	1200-0455	6	1	SOCKET-IC 8-CONT DIP-SLDR	28480	1200-0455

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. 8410B Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A10	08410-6049	0	1	ASSEMBLY, WIRING INTERCONNECT BOARD INCLUDES ONLY XA1, CR1 THRU 8	28480	08410-6049
A10C1	0180-2292	8	3	CAPACITOR-FXD 3900UF+75-10% 50VDC AL	00853	500392U050AC2A
A10C2	0180-2292	8		CAPACITOR-FXD 3900UF+75-10% 50VDC AL	00853	500392U050AC2A
A10C3	0180-2292	8		CAPACITOR-FXD 3900UF+75-10% 50VDC AL	00853	500392U050AC2A
A10C4	0180-0050	2	1	CAPACITOR-FXD 40UF+75-10% 50VDC AL	56289	30D406G050DD2
A10C5				NOT ASSIGNED		
A10C6				NOT ASSIGNED		
A10C7	0180-0094	4	2	CAPACITOR-FXD 100UF+75-10% 25VDC AL	56289	30D107G025DD2
A10C8	0180-0094	4		CAPACITOR-FXD 100UF+75-10% 25VDC AL	56289	30D107G025DD2
A10C9	0180-0374	3	2	CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A10C10	0180-0374	3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A10C11	0140-0210	2	2	CAPACITOR-FXD 270PF +-5% 300VDC MICA	72136	DM15F271J0300WV1CR
A10C12	0140-0210	2		CAPACITOR-FXD 270PF +-5% 300VDC MICA	72136	DM15F271J0300WV1CR
A10CR1	1901-0026	3	8	DIODE-PWR RECT 200V 750MA DO-29	28480	1901-0026
A10CR2	1901-0026	3		DIODE-PWR RECT 200V 750MA DO-29	28480	1901-0026
A10CR3	1901-0026	3		DIODE-PWR RECT 200V 750MA DO-29	28480	1901-0026
A10CR4	1901-0026	3		DIODE-PWR RECT 200V 750MA DO-29	28480	1901-0026
A10CR5	1901-0026	3		DIODE-PWR RECT 200V 750MA DO-29	28480	1901-0026
A10CR6	1901-0026	3		DIODE-PWR RECT 200V 750MA DO-29	28480	1901-0026
A10CR7	1901-0026	3		DIODE-PWR RECT 200V 750MA DO-29	28480	1901-0026
A10CR8	1901-0026	3		DIODE-PWR RECT 200V 750MA DO-29	28480	1901-0026
A10Q1	1854-0063	7	3	TRANSISTOR NPN 2N3055 SI TO-3 PD=115W	28480	1854-0063
A10Q2	1854-0063	7		TRANSISTOR NPN 2N3055 SI TO-3 PD=115W	28480	1854-0063
A10Q3	1854-0063	7		TRANSISTOR NPN 2N3055 SI TO-3 PD=115W	28480	1854-0063
	1200-0043	8	1	INSULATOR-XSTR ALUMINUM	28480	1200-0043
	1200-0147	3	1	INSULATOR-FLG-BSHG NYLON	28480	1200-0147
A10XA1	1251-1886	6	1	CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-1886
A10A1	08410-6050	3	1	ASSEMBLY, POWER SUPPLY BOARD	28480	08410-6050
A10A1C1	0180-2205	3	1	CAPACITOR-FXD .33UF+-10% 35VDC TA	56289	150D334X9035A2
A10A1C2				DELETED		
A10A1C3	0160-4300	1	2	CAPACITOR-FXD .047UF +80-20% 100VDC CER	56289	C023F101L473ZS22-CDH
A10A1C4				DELETED		
A10A1C5	0180-0229	7	1	CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A10A1C6	0160-4300	1		CAPACITOR-FXD .047UF +80-20% 100VDC CER	56289	C023F101L473ZS22-CDH
A10A1C7				DELETED		
A10A1C8				NOT ASSIGNED		
A10A1C9	0180-0291	3	10	CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A10A1C10	0180-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A10A1C11	0180-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A10A1CR1	1901-0025	2	3	DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A10A1CR2	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A10A1CR3	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A10A1Q1	1853-0001	1	3	TRANSISTOR PNP SI TO-39 PD=600MW	28480	1853-0001
A10A1Q2	1853-0001	1		TRANSISTOR PNP SI TO-39 PD=600MW	28480	1853-0001
A10A1Q3	1853-0020	4	5	TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A10A1Q4	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A10A1Q5	1853-0001	1		TRANSISTOR PNP SI TO-39 PD=600MW	28480	1853-0001
A10A1R1	0757-0180	2	1	RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A10A1R2	0757-0280	3	28	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A10A1R3	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A10A1R4	0757-0442	9	12	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A10A1R5	0757-0199	3	1	RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A10A1R6	0811-1552	0	1	RESISTOR .56 5% 2W PW TC=0+-800	75042	BWH2-9/16-J
A10A1R7				DELETED		
A10A1R8	0698-3155	9	12	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A10A1R9	2100-2632	4	1	RESISTOR-TRMR 100 10% C SIDE-ADJ 1-TRN	30983	ET50X101
A10A1R10	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A10A1R11	0698-3157	3	2	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A10A1R12	0698-0084	9	2	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A10A1R13	0698-3444	1	1	RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A10A1R14	0757-0279	0	5	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A10A1R15	0764-0015	7	1	RESISTOR 560 5% 2W MO TC=0+-200	28480	0764-0015
A10A1R16	0811-1662	3	2	RESISTOR .47 5% 2W PW TC=0+-800	75042	BWH2-47/100-J
A10A1R17				DELETED		
A10A1R18	0698-3160	8	3	RESISTOR 31.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3162-F
A10A1R19	0698-3162	0	1	RESISTOR 46.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4642-F
A10A1R20	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F

See introduction to this section for ordering information
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Table 6-3. 8410B Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A10A1R21	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A10A1R22	2100-1756	1	1	RESISTOR-TRMR 200 5% WW SIDE-ADJ 1-TRN	28480	2100-1756
A10A1R23	0698-0083	8	8	RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A10A1R24	0757-0401	0	27	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A10A1R25	0698-3631	8	1	RESISTOR 330 5% 2W MO TC=0+-200	28480	0698-3631
A10A1R26	0811-1662	3		RESISTOR .47 5% 2W PW TC=0+-800	75042	BWH2-47/100-J
A10A1R27	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A10A1R28				DELETED		
A10A1R29	0757-0200	7	2	RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A10A1R30	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A10A1R31	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A10A1R32	0757-0288	1	2	RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A10A1U1	1820-0196	6	3	IC 723 V RGLTR TO-100	04713	MC1723CG
A10A1U2	1820-0196	6		IC 723 V RGLTR TO-100	04713	MC1723CG
A10A1U3	1820-0196	6		IC 723 V RGLTR TO-100	04713	MC1723CG
A11	08410-60073	1	1	ASSY, AMPLITUDE ATTEN. AMPLIFIER BOARD	28480	08410-60073
A11C1*	0140-0197	4	1	CAPACITOR-FXD 180PF +-5% 300VDC MICA	72136	DM15F181J0300WV1CR
A11C2	0150-0121	5	16	CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A11C3	0160-0174	9	2	CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A11C4*	0160-3076	6	2	CAPACITOR-FXD 470PF +-5% 200VDC CER	28480	0160-3076
A11C5				DELETED		
A11C6	0140-0184	9	2	CAPACITOR-FXD 8200PF +-1% 100VDC MICA	72136	DM20F822F0100WV1CR
A11C7*	0160-0939	4	3	CAPACITOR-FXD 430PF +-5% 300VDC MICA	28480	0160-0939
A11C8	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A11C9	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A11C10	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A11C11	0160-0174	9		CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A11C12	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A11C13	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A11C14	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A11C15	0180-0197	8	3	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A11C16	0160-2261	9	1	CAPACITOR-FXD 15PF +-5% 500VDC CER 0+-30	28480	0160-2261
A11C17	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A11C18	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A11C19	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A11CR1	1902-0049	2	1	DIODE-ZNR 6.19V 5% DO-7 PD=.4W TC=+.022%	28480	1902-0049
A11L1	9100-2209	8	2	COIL-MLD 37.8UH 5% Q=135 .75DX.61LG-NOM	28480	9100-2209
A11L2	9140-0131	5	1	COIL-MLD 10MH 5% Q=80 .24DX.74LG-NOM	28480	9140-0131
A11Q1	1854-0071	7	8	TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A11Q2	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A11Q3	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A11Q4	1853-0012	4	1	TRANSISTOR PNP 2N2904A SI TO-39 PD=600MW	01295	2N2904A
A11Q5	1855-0081	1	1	TRANSISTOR J-FET N-CHAN D-MODE SI	01295	2N5245
A11Q6	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A11R1	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A11R2	0698-3159	5	2	RESISTOR 26.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2612-F
A11R3	0757-0424	7	1	RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
A11R4*	0698-0082	7	3	RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A11R5	0698-3440	7	22	RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A11R6	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A11R7	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A11R8	0698-3154	0	2	RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A11R9	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A11R10	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A11R11	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A11R12	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A11R13	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A11R14	0757-0438	3	13	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A11R15	0698-3447	4	1	RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A11R16	0757-0420	3	1	RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A11R17	0757-0416	7	10	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A11R18	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A11R19	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A11R20	0698-7236	7	3	RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-G
A11R21	0698-7255	0	1	RESISTOR 6.19K 1% .05W F TC=0+-100	24546	C3-1/8-T0-6191-G
A11R22	0698-7242	5	1	RESISTOR 1.78K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1781-G
A11R23	0698-7219	6	2	RESISTOR 196 1% .05W F TC=0+-100	24546	C3-1/8-T0-196R-G
A11R24	0698-7219	6		RESISTOR 196 1% .05W F TC=0+-100	24546	C3-1/8-T0-196R-G
A11R25	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-G
A11R26	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-G
A11R27	0698-7260	7	3	RESISTOR 10K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1002-G
A11R28	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1002-G
A11R29	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1002-G

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. 8410B Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A12	08410-6038	7	1	ASSY, TEST AGC AMPLIFIER BOARD	28480	08410-6038
A12C1	0160-2204	0	4	CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A12C2	0160-2055	9	43	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A12C3	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A12C4	0140-0194	1	6	CAPACITOR-FXD 110PF +-5% 300VDC MICA	72136	DM15F111J0300WV1CR
A12C5	0140-0194	1		CAPACITOR-FXD 110PF +-5% 300VDC MICA	72136	DM15F111J0300WV1CR
A12C6	0140-0194	1		CAPACITOR-FXD 110PF +-5% 300VDC MICA	72136	DM15F111J0300WV1CR
A12C7	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A12C8	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A12C9	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A12C10	0160-2201	7	1	CAPACITOR-FXD 51PF +-5% 300VDC MICA	28480	0160-2201
A12C11	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A12C12	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A12C13	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A12C14	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A12C15	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A12C16	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A12C17	0140-0177	0	2	CAPACITOR-FXD 400PF +-1% 300VDC MICA	72136	DM15F401F0300WV1CR
A12C18	0170-0066	9	2	CAPACITOR-FXD .027UF +-10% 200VDC POLYE	28480	0170-0066
A12C19	0180-2127	8	2	CAPACITOR-FXD .15UF+-5% 35VDC TA	56289	150D154X5035A2
A12C20	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A12C21	0160-2229	9	2	CAPACITOR-FXD 3000PF +-5% 300VDC MICA	28480	0160-2229
A12CR1	1901-0050	3	8	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A12CR2	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A12CR3	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A12CR4	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A12CR5 A12CR6	08410-8005	0	1	DIODES: MATCHED QUAD, MATCHED A12CR5 & 6, A14CR5 & 6	28480	08410-8005
A12CR7				DELETED		
A12CR8				DELETED		
A12L1	9100-0348	2	2	COIL-MLD 1UH 1% Q=50 .155DX.375LG-NOM	28480	9100-0348
A12L2	9100-2516	0	2	COIL 100UH 10% .375DX1LG-NOM	04213	6150-7
A12L3				DELETED		
A12Q1	1854-0073	9	15	TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0073
A12Q2	1854-0073	9		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0073
A12Q3	1854-0073	9		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0073
A12Q4	1854-0073	9		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0073
A12Q5	08410-8003	6	1	TRANSISTORS: REPLACE IN PAIRS MATCHED TO A14Q5	28480	08410-8003
A12Q6	1854-0073	9		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0073
A12Q7	08410-8001	2	1	TRANSISTORS: REPLACE IN PAIRS MATCHED TO A14Q7	28480	08410-8001
A12R1	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A12R2	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A12R3	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A12R4	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A12R5	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A12R6	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A12R7	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A12R8	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A12R9	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A12R10	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A12R11	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A12R12	0757-0400	9	4	RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A12R13	0698-3156	2	2	RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A12R14	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A12R15	0757-0428	1	2	RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A12R16	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A12R17	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A12R18	0757-0444	1	2	RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A12R19	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A12R20	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A12R21				DELETED		
A12R22	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A12R23	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A12R24	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A12R25	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A12R26	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A12R27	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A12R28	0757-0394	0	2	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A12R29	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A12R30	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A12R31	0757-0417	8	2	RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F
A12R32	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A12R33	0698-3442	9	2	RESISTOR 237 1% .125W F TC=0+-100	24546	C4-1/8-T0-237R-F
A12R34	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. 8410B Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A12Z1	9170-0847	3	4	CORE-SHIELDING BEAD	02114	56-590-65/3B PARYLENE COATED
A12Z2	9170-0847	3		CORE-SHIELDING BEAD	02114	56-590-65/3B PARYLENE COATED
A13	08410-6008	4	1	ASSY:20,278 MHZ OSCILLATOR BOARD	28480	08410-6008
A13C1	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A13C2	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A13C3	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A13C4	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A13C5	0140-0199	6	1	CAPACITOR-FXD 240PF +-5% 300VDC MICA	72136	DM15F241J0300WV1CR
A13C6	0160-2218	6	3	CAPACITOR-FXD 1000PF +-5% 300VDC MICA	28480	0160-2218
A13C7	0121-0105	4	1	CAPACITOR-V TRMR-CER 9-35PF 200V PC-MTG	52763	304324 9/35PF N650
A13C8	0160-2246	0	1	CAPACITOR-FXD 3.6PF +-.25PF 500VDC CER	28480	0160-2246
A13C9	0140-0205	5	1	CAPACITOR-FXD 62PF +-5% 300VDC MICA	72136	DM15E620J0300WV1CR
A13C10	0160-2204	0		CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A13C11	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A13C12	0160-2204	0		CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A13C13	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A13C14	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A13C15	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A13C16	0160-0939	4		CAPACITOR-FXD 430PF +-5% 300VDC MICA	28480	0160-0939
A13C17	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A13C18	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A13C19	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A13C20	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A13C21	0160-2202	8	1	CAPACITOR-FXD 75PF +-5% 300VDC MICA	28480	0160-2202
A13CR1	1910-0022	8	4	DIODE-GE 5V 60MA 3.5NS DO-7	28480	1910-0022
A13CR2	1910-0022	8		DIODE-GE 5V 60MA 3.5NS DO-7	28480	1910-0022
A13L1	9100-1631	8	1	COIL-MLD 56UH 5% Q=55 .155DX.375LG-NOM	28480	9100-1631
A13L2	9140-0094	9	1	COIL-MLD 680NH 10% Q=50 .155DX.375LG-NOM	28480	9140-0094
A13Q1	1853-0034	0	3	TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
A13Q2	1854-0073	9		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0073
A13Q3	1854-0073	9		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0073
A13Q4	1854-0073	9		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0073
A13Q5	1853-0034	0		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
A13R1	0757-0289	2	1	RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A13R2	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A13R3	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A13R4	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A13R5	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A13R6	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A13R7	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A13R8	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A13R9	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A13R10	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A13R11	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A13R12	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A13R13	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A13R14	0757-0422	5	2	RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A13R15	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A13R16	0698-3150	6	3	RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A13R17	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A13R18	0757-1094	9	1	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A13R19	0757-0403	2	1	RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
A13R20	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A13R21	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A13R22	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A13R23	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A13R24	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A13R25	0757-0422	5		RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A13R26	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A13R27	0698-3150	6		RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A13R28	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A13R29	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A13R30	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A13XY1	1200-0191	7	1	SOCKET-XTAL 2-CONT HC-25/U DIP-SLDR	28480	1200-0191
A13Y1				NSR, PART OF A6Y1		
A14	08410-6039	9	1	ASSY, REF. AGC AMPLIFIER BOARD	28480	08410-6039
A14C1	0160-2204	0		CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A14C2	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A14C3	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A14C4	0140-0194	1		CAPACITOR-FXD 110PF +-5% 300VDC MICA	72136	DM15F111J0300WV1CR
A14C5	0140-0194	1		CAPACITOR-FXD 110PF +-5% 300VDC MICA	72136	DM15F111J0300WV1CR

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. 8410B Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A14C6	0140-0194	1		CAPACITOR-FXD 110PF +-5% 300VDC MICA	72136	DM15F111J0300WV1CR
A14C7	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A14C8	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A14C9	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A14C10	0160-2150	5	1	CAPACITOR-FXD 33PF +-5% 300VDC MICA	28480	0160-2150
A14C11	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A14C12	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A14C13	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A14C14	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A14C15	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A14C16	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A14C17	0140-0177	0		CAPACITOR-FXD 400PF +-1% 300VDC MICA	72136	DM15F401F0300WV1CR
A14C18	0170-0066	9		CAPACITOR-FXD .027UF +-10% 200VDC POLYE	28480	0170-0066
A14C19	0180-2127	8		CAPACITOR-FXD .15UF+-5% 35VDC TA	56289	150D154X5035A2
A14C20	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A14C21				DELETED		
A14CR1	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A14CR2	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A14CR3	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A14CR4	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A14CR5				PART OF A12CR5		
A14CR6				PART OF A12CR5		
A14CR7				DELETED		
A14CR8				DELETED		
A14L1	9100-0348	2		COIL-MLD 1UH 1% Q=50 .155DX.375LG-NOM	28480	9100-0348
A14L2	9100-2516	0		COIL 100UH 10% .375DX1LG-NOM	04213	6150-7
A14L3				DELETED		
A14Q1	1854-0073	9		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0073
A14Q2	1854-0073	9		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0073
A14Q3	1854-0073	9		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0073
A14Q4	1854-0073	9		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0073
A14Q5				PART OF A12Q5, REPLACE IN PAIRS		
A14Q6	1854-0073	9		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0073
A14Q7				PART OF A12Q7, REPLACE IN PAIRS		
A14R1	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A14R2	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A14R3	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A14R4	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A14R5	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A14R6	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A14R7	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A14R8	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A14R9	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A14R10	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A14R11	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A14R12	0757-0400	9		RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A14R13	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A14R14	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A14R15	0757-0428	1		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A14R16	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A14R17	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A14R18	0757-0444	1		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A14R19	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A14R20	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A14R21				DELETED		
A14R22	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A14R23	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A14R24	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A14R25	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A14R26	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A14R27	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A14R28	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A14R29	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A14R30	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A14R31	0757-0417	8		RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F
A14R32	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A14R33	0698-3442	9		RESISTOR 237 1% .125W F TC=0+-100	24546	C4-1/8-T0-237R-F
A14R34	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A14Z1	9170-0847	3		CORE-SHIELDING BEAD	02114	56-590-65/3B PARYLENE COATED
A14Z2	9170-0847	3		CORE-SHIELDING BEAD	02114	56-590-65/3B PARYLENE COATED
A15	08410-6040	2	1	ASSY:AGC-DC AMPLIFIER BOARD	28480	08410-6040

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. 8410B Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A15C1	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A15C2	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A15C3	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A15C4	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A15C5	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A15C6	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A15C7	0160-2218	6		CAPACITOR-FXD 1000PF +-5% 300VDC MICA	28480	0160-2218
A15C8	0160-2218	6		CAPACITOR-FXD 1000PF +-5% 300VDC MICA	28480	0160-2218
A15C9	0180-1735	2	1	CAPACITOR-FXD .22UF+-10% 35VDC TA	56289	150D224X9035A2
A15C10	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A15C11	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A15C12	0160-2209	5	1	CAPACITOR-FXD 360PF +-5% 300VDC MICA	28480	0160-2209
A15C13	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A15C14	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A15C15	0160-2229	9		CAPACITOR-FXD 3000PF +-5% 300VDC MICA	28480	0160-2229
A15C16	0160-2228	8	1	CAPACITOR-FXD 2700PF +-5% 300VDC MICA	28480	0160-2228
A15C17	0160-0136	3	1	CAPACITOR-FXD 2500PF +-1% 300VDC MICA	28480	0160-0136
A15CR1	1910-0022	8		DIODE-GE 5V 60MA 3.5NS DO-7	28480	1910-0022
A15CR2	1910-0022	8		DIODE-GE 5V 60MA 3.5NS DO-7	28480	1910-0022
A15CR3	1901-0033	2	3	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A15CR4	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A15CR5	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A15L1	9100-1621	6	1	COIL-MLD 18UH 10% Q=75 .155DX.375LG-NOM	28480	9100-1621
A15L2	9100-1638	5	1	COIL-MLD 130UH 5% Q=65 .155DX.375LG-NOM	28480	9100-1638
A15Q1	1854-0073	9		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0073
A15Q2	1853-0034	0		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
A15Q3	1854-0073	9		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0073
A15Q4	1854-0475	5	1	TRANSISTOR-DUAL NPN PD=750MW (ALTERNATE REPLACEMENT IS 1854-0221)	28480	1854-0475
A15Q5				PART OF A15Q4A AND B		
A15Q6	1853-0009	9	1	TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0009
A15Q7	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A15Q8	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A15R1	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A15R2	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A15R3	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A15R4	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A15R5	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A15R6	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A15R7	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A15R8	0698-0085	0	1	RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F
A15R9	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A15R10	0757-0443	0	4	RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A15R11	0757-0288	1		RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A15R12	0698-3150	6		RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A15R13	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A15R14	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A15R15	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A15R16	0757-0443	0		RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A15R17	0698-3435	0	1	RESISTOR 38.3 1% .125W F TC=0+-100	24546	C4-1/8-T0-38R3-F
A15R18	0757-0441	8	1	RESISTOR 8.25K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8251-F
A15R19	0757-0443	0		RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A15R20	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A15R21*	0698-3155	1	2	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A15R22	0698-3160	8		RESISTOR 31.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3162-F
A15R23	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A15R24	0757-0488	3	1	RESISTOR 909K 1% .125W F TC=0+-100	28480	0757-0488
A15R25	0757-0400	9		RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A15R26	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A15R27	0757-0436	1	1	RESISTOR 4.32K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4321-F
A15R28	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A15R29	0757-0443	0		RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A15R30	0757-0278	9	1	RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A15R31	0698-3159	5		RESISTOR 26.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2612-F
A15R32*	0757-0461	2	1	RESISTOR 68.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6812-F
A15R33	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A15R34	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A15R35	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A15R36	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A15R37	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A15R38	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A15VR1	1902-3171	7	1	DIODE-ZNR 11V 5% DO-7 PD=.4W TC=+.062%	28480	1902-3171

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. 8410B Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A16	08410-60062	8	1	ASSY:278 MHZ REF, AMPLIFIER BOARD	28480	08410-60062
A16C1	0160-2227	7	2	CAPACITOR-FXD 2400PF +-5% 300VDC MICA	28480	0160-2227
A16C2	0160-2227	7		CAPACITOR-FXD 2400PF +-5% 300VDC MICA	28480	0160-2227
A16C3	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A16C4	0180-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A16C5	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A16C6	0180-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A16C7	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A16C8	0140-0184	9		CAPACITOR-FXD 8200PF +-1% 100VDC MICA	72136	DM20F822F0100WV1CR
A16C9	0160-3076	6		CAPACITOR-FXD 470PF +-5% 200VDC CER	28480	0160-3076
A16C10*	0160-0939	4		CAPACITOR-FXD 430PF +-5% 300VDC MICA	28480	0160-0939
A16C11	0180-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A16C12	0180-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A16C13	0180-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A16C14	0180-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A16C15	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A16C16	0180-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A16C17	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A16L1	9100-2209	8		COIL-MLD 37.8UH 5% Q=135 .75DX.61LG-NOM	28480	9100-2209
A16Q1	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A16Q2	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A16Q3	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A16Q4	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A16Q5	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A16R1	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A16R2	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A16R3	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A16R4	0698-3160	8		RESISTOR 31.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3162-F
A16R5	0757-0200	7		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A16R6	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A16R7	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A16R8	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A16R9	0757-0400	9		RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A16R10	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A16R11	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A16R12	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A16R13*	0757-0317	7	1	RESISTOR 1.33K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1331-F
A16R14	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A16R15	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A16R16	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A16R17	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A16R18	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A16R19	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A16R20	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A16R21	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A16R22	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A16R23	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A16R24	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A16R25	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. 8410B Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A17	08410-60109	4	1	BOARD ASSEMBLY, EXTENDER	28480	08410-60109
A18	08410-60107	2	1	BOARD ASSEMBLY, A/D CONVERTER	28480	08410-60107
A18C1	0180-1746	5	2	CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A18C2	0160-3466	8	1	CAPACITOR-FXD 100PF +-10% 1KVDC CER	28480	0160-3466
A18C3	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A18CR1	1901-0470	1	1	DIODE-HV RECT 1KV 600MA DO-41	28480	1901-0470
A18MP1	5040-6843	2	2	EXTRACTOR, P.C. BOARD	28480	5040-6843
A18MP2	5000-9043	6	2	PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
A18Q1	1854-0071	7	1	TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A18R1	0698-0082	7	1	RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A18R2	2100-3154	7	1	RESISTOR-TRMR 1K 10% C SIDE-ADJ 17-TRN	02111	43P102
A18R3	0757-0421	4	3	RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A18R4	0757-0424	7	1	RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
A18R5	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A18R6	0757-0417	8	2	RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F
A18R7	0698-3446	3	1	RESISTOR 383 1% .125W F TC=0+-100	24546	C4-1/8-T0-383R-F
A18R8	0698-3443	0	2	RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A18R9	0698-3440	7	2	RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A18R10	0698-3438	3	2	RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A18R11	0757-0401	0	1	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A18R12	0757-0397	3	1	RESISTOR 68.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-68R1-F
A18R13	0757-0394	0	2	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A18R14	0698-3434	9	1	RESISTOR 34.8 1% .125W F TC=0+-100	24546	C4-1/8-T0-34R8-F
A18R15	0698-3432	7	1	RESISTOR 26.1 1% .125W F TC=0+-100	03888	PME55-1/8-T0-26R1-F
A18R16	0757-0276	7	1	RESISTOR 61.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A18R17	0757-0416	7	1	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A18R18	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A18R19	0757-0458	7	1	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A18R20	0757-0462	3	6	RESISTOR 75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7502-F
A18R21	0698-3450	9	1	RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A18R22	0757-0465	6	5	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A18R23	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A18R24	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A18R25	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A18R26	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A18R27	0698-3159	5	1	RESISTOR 26.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2612-F
A18U1	1820-1534	8	1	IC GATE CMOS NOR QUAD 2-INP	01928	CD4001AF
A18U2	1820-1535	9	2	IC GATE CMOS NOR TPL 3-INP	01928	CD4025AF
A18U3	1820-1570	2	2	IC ENCDR CMOS 8-BIT	04713	MC14532CL
A18U4	1820-1570	2		IC ENCDR CMOS 8-BIT	04713	MC14532CL
A18U5	1820-1540	6	4	IC LCH CMOS D-TYPE QUAD	01928	CD4042AF
A18U6	1820-1540	6		IC LCH CMOS D-TYPE QUAD	01928	CD4042AF
A18U7	1826-0026	3	1	COMPARATOR PRCN TO-99	04713	MLM311G
A18U8	1826-0161	7	3	OP AMP GP QUAD 14-DIP-P	04713	MLM324P
A18U9	1820-1540	6		IC LCH CMOS D-TYPE QUAD	01928	CD4042AF
A18U10	1820-1540	6		IC LCH CMOS D-TYPE QUAD	01928	CD4042AF
A18U11	1826-0161	7		OP AMP GP QUAD 14-DIP-P	04713	MLM324P
A18U12	1826-0161	7		OP AMP GP QUAD 14-DIP-P	04713	MLM324P
A18VR1	1902-0680	7	1	DIODE-ZNR 1N827 6.2V 5% DO-7 PD=.25W	24046	1N827
A18VR2	1902-0071	0	1	DIODE-ZNR 9V 5% DO-14 PD=.5W TC=+.001%	28480	1902-0071
A18VR3	1902-3256	9	1	DIODE-ZNR 23.7V 5% DO-7 PD=.4W TC=+.076%	28480	1902-3256
A18VR4	1902-3182	0	1	DIODE-ZNR 12.1V 5% DO-7 PD=.4W TC=+.064%	28480	1902-3182
A18XU1	1200-0508	0	6	SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0508
A18XU2	1200-0508	0		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0508
A18XU3	1200-0507	9	8	SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0507
A18XU4	1200-0507	9		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0507
A18XU5	1200-0507	9		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0507
A18XU6	1200-0507	9		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0507
A18XU7	1200-0455	6	1	SOCKET-IC 8-CONT DIP-SLDR	28480	1200-0455
A18XU8	1200-0508	0		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0508
A18XU9	1200-0507	9		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0507
A18XU10	1200-0507	9		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0507
A18XU11	1200-0508	0		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0508
A18XU12	1200-0508	0		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0508
A19	08410-60108	3	1	BOARD ASSEMBLY, FREQUENCY RANGE	28480	08410-60108

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. 8410B Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A19C1	0180-0374	3	1	CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A19MP1	5040-6843	2		EXTRACTOR, P.C. BOARD	28480	5040-6843
A19MP2	5000-9043	6		PIN;P.C. BOARD EXTRACTOR	28480	5000-9043
A19Q1	1855-0082	2	5	TRANSISTOR J-FET P-CHAN D-MODE SI	28480	1855-0082
A19Q2	1855-0082	2		TRANSISTOR J-FET P-CHAN D-MODE SI	28480	1855-0082
A19Q3	1855-0082	2		TRANSISTOR J-FET P-CHAN D-MODE SI	28480	1855-0082
A19Q4	1855-0082	2		TRANSISTOR J-FET P-CHAN D-MODE SI	28480	1855-0082
A19Q5	1855-0082	2		TRANSISTOR J-FET P-CHAN D-MODE SI	28480	1855-0082
A19Q6	1855-0020	8	29	TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A19Q7	1855-0020	8		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A19Q8	1855-0020	8		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A19Q9	1855-0020	8		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A19Q10	1855-0020	8		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A19Q11	1855-0020	8		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A19Q12	1855-0020	8		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A19Q13	1855-0020	8		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A19Q14	1855-0020	8		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A19Q15	1855-0020	8		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A19Q16	1855-0020	8		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A19Q17	1855-0020	8		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A19Q18	1855-0020	8		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A19Q19	1855-0020	8		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A19Q20	1855-0020	8		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A19Q21	1855-0020	8		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A19Q22	1855-0020	8		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A19Q23	1855-0020	8		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A19Q24	1855-0020	8		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A19Q25	1855-0020	8		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A19Q26	1855-0020	8		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A19Q27	1855-0020	8		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A19Q28	1855-0020	8		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A19Q29	1855-0020	8		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A19Q30	1855-0020	8		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A19Q31	1855-0020	8		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A19Q32	1855-0020	8		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A19Q33	1855-0020	8		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A19Q34	1855-0020	8		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A19R1	0757-0462	3		RESISTOR 75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7502-F
A19R2	0757-0462	3		RESISTOR 75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7502-F
A19R3	0757-0462	3		RESISTOR 75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7502-F
A19R4	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A19R5	0757-0462	3		RESISTOR 75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7502-F
A19R6	0757-0462	3		RESISTOR 75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7502-F
A19R7	0698-3154	0	1	RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A19R8	0757-0440	7	1	RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A19R9	0698-3260	9	29	RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A19R10	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A19R11	0757-0199	3	1	RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A19R12	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A19R13	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A19R14	0757-0279	0	1	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A19R15	0698-3429	2	1	RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
A19R16	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A19R17	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A19R18	0757-0428	1	1	RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A19R19	0757-0399	5	1	RESISTOR 82.5 1% .125W F TC=0+-100	24546	C4-1/8-T0-82R5-F
A19R20	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A19R21	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A19R22	0757-0420	3	1	RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A19R23	0698-3444	1	2	RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A19R24	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A19R25	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A19R26	0757-0417	8		RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F
A19R27	0698-3447	4	1	RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A19R28	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A19R29	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A19R30	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A19R31	0757-0418	9	1	RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A19R32	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A19R33	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A19R34	0698-3443	0		RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A19R35	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A19R36	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A19R37	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A19R38	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A19R39	0757-1094	9	1	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A19R40	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260

See introduction to this section for ordering information
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Table 6-3. 8410B Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A19R41	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A19R42	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A19R43	0698-0083	8	1	RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A19R44	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A19R45	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A19R46	0757-0402	1	1	RESISTOR 110 1% .125W F TC=0+-100	24546	C4-1/8-T0-111-F
A19R47	0698-3152	8	1	RESISTOR 3.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3481-F
A19R48	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A19R49	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A19R50	0757-0398	4	1	RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A19R51	0757-0200	7	1	RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A19R52	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A19R53	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A19R54	0757-0395	1	1	RESISTOR 56.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-56R2-F
A19R55	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A19R56	0757-0438	3	1	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A19R57	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A19R58	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A19R59	0698-3435	0	1	RESISTOR 38.3 1% .125W F TC=0+-100	24546	C4-1/8-T0-38R3-F
A19R60	0757-0439	4	1	RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A19R61	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A19R62	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A19R63	0698-3431	6	1	RESISTOR 23.7 1% .125W F TC=0+-100	03888	PME55-1/8-T0-23R7-F
A19R64	0757-0288	1	1	RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A19R65	0698-3156	2	1	RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A19S1	3101-1273	0	1	SWITCH-SL DPDTSUBMIN 2A 120VAC PC	28480	3101-1273
A19U1	1820-1526	8	2	IC DCDR CMOS BCD-TO-DEC 4-TO-10-LINE	04713	MC14028CL
A19U2	1820-1526	8		IC DCDR CMOS BCD-TO-DEC 4-TO-10-LINE	04713	MC14028CL
A19U3	1820-1535	9		IC GATE CMOS NOR TPL 3-INP	01928	CD4025AF
A19VR1	1902-3193	3	1	DIODE-ZNR 13.3V 5% DO-7 PD=.4W TC=+.059%	28480	1902-3193
A19XU1	1200-0507	9		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0507
A19XU2	1200-0507	9		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0507
A19XU3	1200-0508	0		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0508

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. 8410B Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
				CHASSIS PARTS		
B1	3160-0088	7	1	FAN-TBAX 35-CFM 115V 50/60-HZ 1.665-THK	28480	3160-0088
C1				DELETED		
C2				DELETED		
C3	0160-2438	2	11	CAPACITOR-STDOFF 5000PF +80 -20% 200V	28480	0160-2438
C4	0160-2437	1	12	CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
C5	0160-2438	2		CAPACITOR-STDOFF 5000PF +80 -20% 200V	28480	0160-2438
C6	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
C7	0160-2438	2		CAPACITOR-STDOFF 5000PF +80 -20% 200V	28480	0160-2438
C8	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
C9	0160-2438	2		CAPACITOR-STDOFF 5000PF +80 -20% 200V	28480	0160-2438
C10	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
C11	0160-2438	2		CAPACITOR-STDOFF 5000PF +80 -20% 200V	28480	0160-2438
C12	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
C13	0160-2438	2		CAPACITOR-STDOFF 5000PF +80 -20% 200V	28480	0160-2438
C14	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
C15	0160-2438	2		CAPACITOR-STDOFF 5000PF +80 -20% 200V	28480	0160-2438
C16	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
C17	0160-2438	2		CAPACITOR-STDOFF 5000PF +80 -20% 200V	28480	0160-2438
C18	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
C19	0160-2438	2		CAPACITOR-STDOFF 5000PF +80 -20% 200V	28480	0160-2438
C20	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
C21	0160-2438	2		CAPACITOR-STDOFF 5000PF +80 -20% 200V	28480	0160-2438
C22	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
C23	0160-2436	0	12	CAPACITOR-FDTHRU 10PF 20% 200V CER	28480	0160-2436
C24	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
C25	0160-2436	0		CAPACITOR-FDTHRU 10PF 20% 200V CER	28480	0160-2436
C26	0160-2436	0		CAPACITOR-FDTHRU 10PF 20% 200V CER	28480	0160-2436
C27	0160-2436	0		CAPACITOR-FDTHRU 10PF 20% 200V CER	28480	0160-2436
C28	0160-2436	0		CAPACITOR-FDTHRU 10PF 20% 200V CER	28480	0160-2436
C29	0160-2436	0		CAPACITOR-FDTHRU 10PF 20% 200V CER	28480	0160-2436
C30	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
C31				DELETED		
C32	0140-0177	0	1	CAPACITOR-FXD 400PF +-1% 300VDC MICA	72136	DM15F401F0300WV1CR
C33	0160-2199	2	1	CAPACITOR-FXD 30PF +-5% 300VDC MICA	28480	0160-2199
C34	0160-2200	6	1	CAPACITOR-FXD 43PF +-5% 300VDC MICA	28480	0160-2200
C35	0180-0116	1	4	CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
C36	0180-0116	1		CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
C37	0180-0116	1		CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
C38	0180-0116	1		CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
C39	0160-2436	0		CAPACITOR-FDTHRU 10PF 20% 200V CER	28480	0160-2436
C40	0160-2438	2		CAPACITOR-STDOFF 5000PF +80 -20% 200V	28480	0160-2438
C41	0160-2436	0		CAPACITOR-FDTHRU 10PF 20% 200V CER	28480	0160-2436
C42	0160-2436	0		CAPACITOR-FDTHRU 10PF 20% 200V CER	28480	0160-2436
C43	0160-2436	0		CAPACITOR-FDTHRU 10PF 20% 200V CER	28480	0160-2436
C44	0160-2436	0		CAPACITOR-FDTHRU 10PF 20% 200V CER	28480	0160-2436
C45	0160-2436	0		CAPACITOR-FDTHRU 10PF 20% 200V CER	28480	0160-2436
C46	0160-0939	4	1	CAPACITOR-FXD 430PF +-5% 300VDC MICA	28480	0160-0939
C47	0160-3333	8	2	CAPACITOR-FXD 5000PF +-20% 250VAC(RMS)	28480	0160-3333
C48	0160-3333	8		CAPACITOR-FXD 5000PF +-20% 250VAC(RMS)	28480	0160-3333
DS1	2140-0244	4	1	LAMP-GLOW A1H 135/105VDC 1.2MA T-2-BULB	0046G	A1H
E1	0360-1031	3	1	TERMINAL, STUD FXD-TUR INT-THD-MTG	28480	0360-1031
F1	2110-0336	2	1	FUSE .8A 250V SLO-BLO 1.25X.25 UL IEC (FOR 230V OPERATION)	28480	2110-0336
F1	2110-0304	4	1	FUSE 1.5A 250V SLO-BLO 1.25X.25 UL IEC (FOR 115V OPERATION)	28480	2110-0304
FL1	0960-0444	2	1	LINE POWER MODULE (RECOMMENDED REPLACEMENT)	28480	0960-0444
J1	5020-3257	4	1	BODY:RECEPTACLE	28480	5020-3257
J1	1251-1359	8	1	CONTACT-CONN MALE CRP	28480	1251-1359
J1	1251-1357	6	1	INS-CONN,MS-M,COAX JACK ASSY	09922	RMDXK-1
J1	5060-0226	5	1	INSULATOR	28480	5060-0226
J1	5020-3259	6	1	NUT:KNURLED	28480	5020-3259
J1	5020-3258	5	1	NUT:HEX	28480	5020-3258
J2	08410-2029	4	1	CONNECTOR, FEMALE MOD	28480	08410-2029
J3	1250-0102	5	3	CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0102
J4	1250-0102	5		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0102
J5	1250-0083	1	2	CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0083
J6	1250-0829	3	8	CONNECTOR-RF SMC M SGL-HOLE-FR 50-OHM	28480	1250-0829

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. 8410B Replaceable Parts

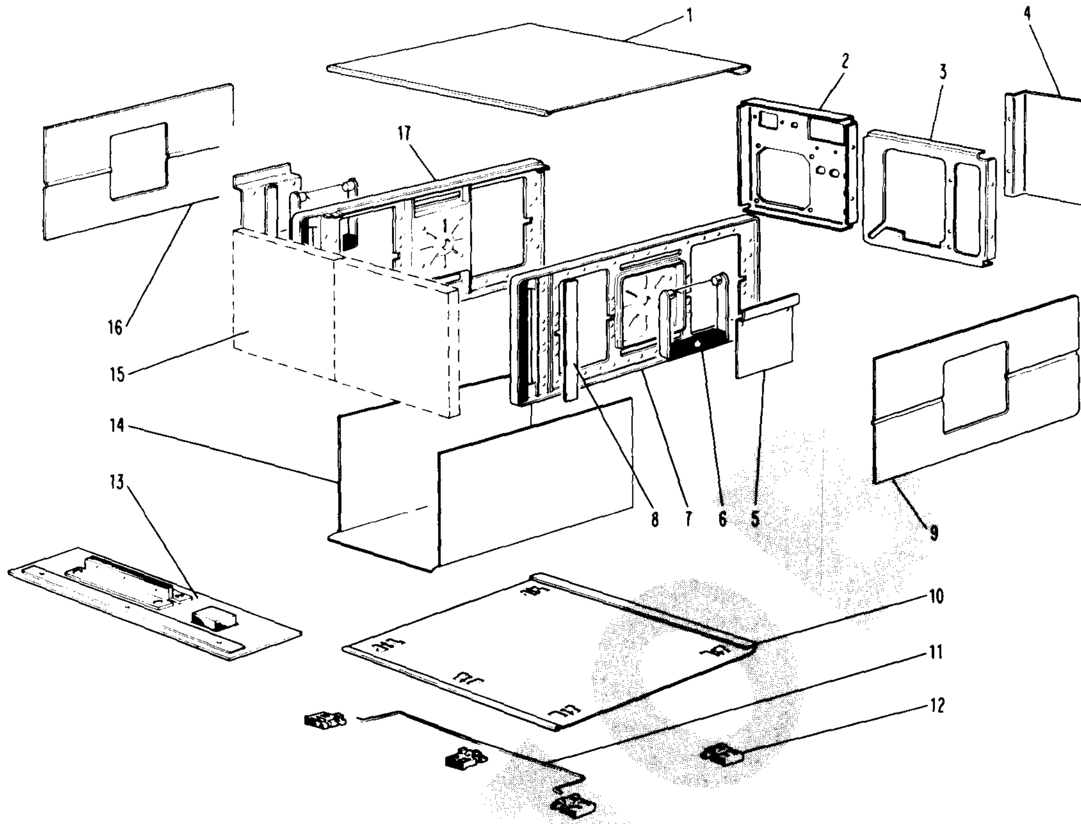
Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
J7	1250-0829	3		CONNECTOR-RF SMC M SGL-HOLE-FR 50-OHM	28480	1250-0829
J8	1250-0829	3		CONNECTOR-RF SMC M SGL-HOLE-FR 50-OHM	28480	1250-0829
J9	1250-0829	3		CONNECTOR-RF SMC M SGL-HOLE-FR 50-OHM	28480	1250-0829
J10	1250-0829	3		CONNECTOR-RF SMC M SGL-HOLE-FR 50-OHM	28480	1250-0829
J11	1250-0829	3		CONNECTOR-RF SMC M SGL-HOLE-FR 50-OHM	28480	1250-0829
J12	1250-0829	3		CONNECTOR-RF SMC M SGL-HOLE-FR 50-OHM	28480	1250-0829
J13	1250-0829	3		CONNECTOR-RF SMC M SGL-HOLE-FR 50-OHM	28480	1250-0829
J14				DELETED		
J15	1250-0083	1		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0083
J16	1250-0102	5		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0102
J17	1251-0143	6	1	CONNECTOR 14-PIN F MICRO RIBBON	28480	1251-0143
J18	1510-0087	7	1	BINDING POST: GREY	28480	1510-0087
	0340-0719	0	1	INSULATOR-BDG POST ABS JADE-GRA	28480	0340-0719
L1	9140-0114	4	10	COIL-MLD 10UH 10% Q=55 .155DX.375LG-NOM	28480	9140-0114
L2	9140-0114	4		COIL-MLD 10UH 10% Q=55 .155DX.375LG-NOM	28480	9140-0114
L3	9140-0114	4		COIL-MLD 10UH 10% Q=55 .155DX.375LG-NOM	28480	9140-0114
L4	9140-0114	4		COIL-MLD 10UH 10% Q=55 .155DX.375LG-NOM	28480	9140-0114
L5	9140-0114	4		COIL-MLD 10UH 10% Q=55 .155DX.375LG-NOM	28480	9140-0114
L6	9140-0114	4		COIL-MLD 10UH 10% Q=55 .155DX.375LG-NOM	28480	9140-0114
L7	9140-0114	4		COIL-MLD 10UH 10% Q=55 .155DX.375LG-NOM	28480	9140-0114
L8	9140-0114	4		COIL-MLD 10UH 10% Q=55 .155DX.375LG-NOM	28480	9140-0114
L9	9140-0114	4		COIL-MLD 10UH 10% Q=55 .155DX.375LG-NOM	28480	9140-0114
L10	9140-0114	4		COIL-MLD 10UH 10% Q=55 .155DX.375LG-NOM	28480	9140-0114
L11	9100-2230	5	1	COIL-MLD 150NH 3% Q=50 .156DX.375LG-NOM	28480	9100-2230
L12	9140-0098	3	1	COIL-MLD 2.2UH 10% Q=33 .155DX.375LG-NOM	28480	9140-0098
L13	9100-2249	6	1	COIL-MLD 150NH 10% Q=34 .095DX.25LG-NOM	28480	9100-2249
M1	1120-1279	4	1	METER10-1 MA	28480	1120-1279
P1	1251-0160	7	13	CONNECTOR-PC EDGE 15-CONT/ROW 1-ROW	28480	1251-0160
Q1	1854-0063	7	2	TRANSISTOR NPN 2N3055 SI TO-3 PD=115W	28480	1854-0063
	1200-0043	8	2	INSULATOR-XSTR ALUMINUM	28480	1200-0043
Q2	1854-0063	7		TRANSISTOR NPN 2N3055 SI TO-3 PD=115W	28480	1854-0063
	1200-0043	8		INSULATOR-XSTR ALUMINUM	28480	1200-0043
R1	2100-0079	9	1	RESISTOR-VAR CONTROL CCP 250 10% LIN	28480	2100-0079
R2	2100-2458	2	1	RESISTOR-VAR DUAL 100-10%-CC 1K-10%-CC	28480	2100-2458
R3	0698-3162	0	1	RESISTOR 46.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4642-F
R4	0813-0040	3	1	RESISTOR 20 5% 5W PW TC=0+-20	28480	0813-0040
R5	0757-0462	3	1	RESISTOR 75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7502-F
S1	3101-1957	7	1	SWITCH-PB DPST-NO ALTNG 10.5A 250VAC	28480	3101-1957
S2				DELETED		
T1	9100-3812	1	1	TRANSFORMER-POWER PRI: 115/240V; SEC: 14	28480	9100-3812
TB1	0360-0014	0	1	BARRIER BLOCK 2-TERM GA1 PHEN .75-IN-L	28480	0360-0014
VR1	1902-1227	0	1	DIODE-ZNR 1N2972B 8.25V 5% DO-4 PD=10W	28480	1902-1227
	1200-0080	3	1	INSULATOR-DIO ALUMINUM HD-ANDZ	28480	1200-0080
W1	08410-6022	4	1	CABLE ASSEMBLY, REFERENCE	28480	08410-6022
W1P1	1250-0888	4	7	CONNECTOR-RF SMC FEM UNMTD 50-OHM	28480	1250-0888
W2	08410-6017	3	1	CABLE ASSEMBLY, 20 MHZ IF	28480	08410-6017
W2P1	1250-0888	4		CONNECTOR-RF SMC FEM UNMTD 50-OHM	28480	1250-0888
W3	08410-6023	6	1	CABLE ASSEMBLY, TEST	28480	08410-6023
W3P1	1250-0888	4		CONNECTOR-RF SMC FEM UNMTD 50-OHM	28480	1250-0888
W4	08410-6020	0	1	CABLE ASSEMBLY, PHASE	28480	08410-6020
W4P1	1250-0888	4		CONNECTOR-RF SMC FEM UNMTD 50-OHM	28480	1250-0888
W5	08410-6025	0		CABLE ASSEMBLY, AMPL VERNIER (IN)	28480	08410-6025
W5P1	1250-0888	4	1	CONNECTOR-RF SMC FEM UNMTD 50-OHM	28480	1250-0888
W6	08410-6019	7	1	CABLE ASSEMBLY, AMPLITUDE	28480	08410-6019
W6P1	1250-0887	3		CONNECTOR-RF SMC FEM UNMTD 50-OHM	28480	1250-0887
W7	08410-6024	8	1	CABLE ASSEMBLY, VTO	28480	08410-6024
W7P1	1250-0888	4		CONNECTOR-RF SMC FEM UNMTD 50-OHM	28480	1250-0888
W8	8120-1348	5	1	CABLE ASSY 18AWG 3-CNDCT BLK-JKT	28480	8120-1348
W9	08410-6021	2	1	CABLE ASSEMBLY, REFERENCE (278 KHZ)	28480	08410-6021
W9P1	1250-0888	4		CONNECTOR-RF SMC FEM UNMTD 50-OHM	28480	1250-0888
W10	08410-6026	2	1	CABLE ASSEMBLY, ATTENUATOR	28480	08410-6026
	1250-0892	0	1	CONNECTOR-RF SMC M UNMTD 50-OHM	28480	1250-0892
W11	08410-6035	1	1	CABLE ASSEMBLY, POWER SUPPLY	28480	08410-6035
W12	08410-60068	4	1	CABLE ASSEMBLY, TEST AMPLIFIER	28480	08410-60068
W13	08410-60059	3	1	CABLE ASSEMBLY, GREY-YELLOW	28480	08410-60059
W14	08410-60069	5	1	CABLE ASSEMBLY, REF-REF CHAN OUTPUT	28480	08410-60069
W15	08410-60071	9	1	CABLE ASSEMBLY, TEST CHAN OUTPUT-J2 CONN	28480	08410-60071
W16	08410-60072	0	1	CABLE ASSEMBLY, REF CHAN OUTPUT -J2 CONN	28480	08410-60072
XA1				NOT ASSIGNED		
XA3				NOT ASSIGNED		
XA4	1251-0160	7		CONNECTOR-PC EDGE 15-CONT/ROW 1-ROW	28480	1251-0160
XA5	1251-0160	7		CONNECTOR-PC EDGE 15-CONT/ROW 1-ROW	28480	1251-0160
XA6	1251-0160	7		CONNECTOR-PC EDGE 15-CONT/ROW 1-ROW	28480	1251-0160

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. 8410B Replaceable Parts

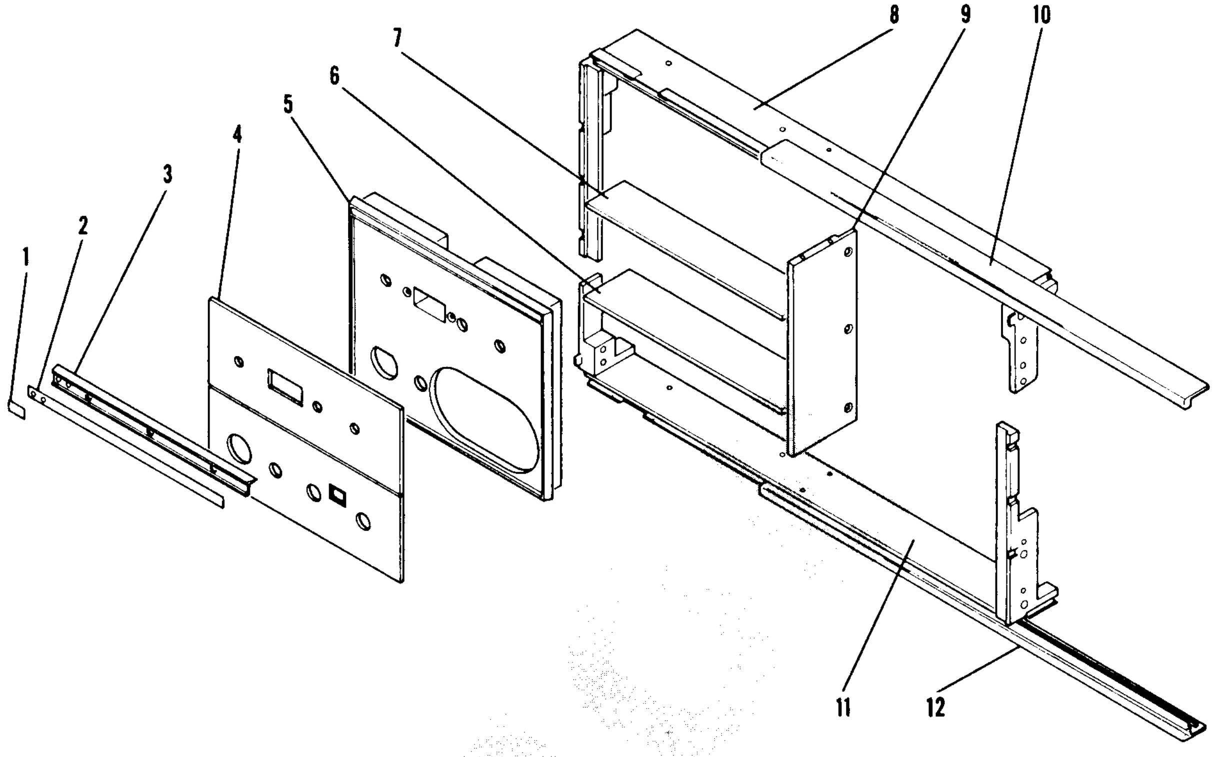
Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
XA7	1251-0160	7		CONNECTOR-PC EDGE 15-CONT/ROW 1-ROW	28480	1251-0160
XA8	1251-0160	7		CONNECTOR-PC EDGE 15-CONT/ROW 1-ROW	28480	1251-0160
XA9	1251-0160	7		CONNECTOR-PC EDGE 15-CONT/ROW 1-ROW	28480	1251-0160
XA10	1251-2261	3	1	CONNECTOR-PC EDGE 15-CONT/ROW 1-ROW	28480	1251-2261
XA11	1251-0160	7		CONNECTOR-PC EDGE 15-CONT/ROW 1-ROW	28480	1251-0160
XA12	1251-0160	7		CONNECTOR-PC EDGE 15-CONT/ROW 1-ROW	28480	1251-0160
XA13	1251-0160	7		CONNECTOR-PC EDGE 15-CONT/ROW 1-ROW	28480	1251-0160
XA14	1251-0160	7		CONNECTOR-PC EDGE 15-CONT/ROW 1-ROW	28480	1251-0160
XA15	1251-0160	7		CONNECTOR-PC EDGE 15-CONT/ROW 1-ROW	28480	1251-0160
XA16	1251-0160	7		CONNECTOR-PC EDGE 15-CONT/ROW 1-ROW	28480	1251-0160
XA17	1251-1190	5	3	CONNECTOR-PC EDGE 12-CONT/ROW 2-ROWS	28480	1251-1190
XA18	1251-1190	5		CONNECTOR-PC EDGE 12-CONT/ROW 2-ROWS	28480	1251-1190
XA19	1251-1190	5		CONNECTOR-PC EDGE 12-CONT/ROW 2-ROWS	28480	1251-1190
				MISCELLANEOUS PARTS		
	08410-61024	4	1	CABLE ASSY:SERVICE(LT, GREY)OPT H26/X95	28480	08410-61024
	08410-6032	5	1	CABLE ASSY:SERVICE(LT, GREY)OPT X95	28480	08410-6032
	08410-61032	4	1	CABLE ASSY:SERVICE(JADE GREY)OPT H26/STD	28480	08410-61032
	08410-60067	3	1	CABLE ASSY:SERVICE(JADE GREY)STD	28480	08410-60067
	08410-0004	0	1	COVER, FXD HOUSING BOARD	28480	08410-0004
	08410-00060	0	1	COVER, MOVABLE HOUSING BOARD	28480	08410-00060
	08410-00059	7	1	COVER, FXD HOUSING CONNECTOR	28480	08410-00059
	08410-0011	5	1	COVER, MOVABLE HOUSING CONNECTOR	28480	08410-0011
	08410-0012	7	1	DIAL, 0-9 DB	28480	08410-0012
	08410-0013	9	1	DIAL, 0-60 DB	28480	08410-0013
	0370-0103	9	2	KNOB:BLK W/ARROW 5/8" OD 1/4" SHAFT	28480	0370-0103
	0370-0363	3	1	KNOB-RND:BLK:FOR .250SHFT:.750D:C*BORED	28480	0370-0363
	0370-0103	9		KNOB:BLK W/ARROW 5/8" OD 1/4" SHAFT	28480	0370-0103
	0370-0114	2	1	KNOB-BASE LRD .125-IN-ID	28480	0370-0114
	5040-0170	6	1	GUIDE:PLUG-IN PC BOARD	28480	5040-0170
	08410-00058	6	1	KNOB, BLACK 3/4" W/DIAL	28480	08410-00058
	08410-0033	1	1	FILTER	28480	08410-0033
	08410-00310	3	1	FRAME, FILTER	28480	08410-00310
	08410-2036	9	1	HEAT SINK, POWER SUPPLY TRANSISTOR	28480	08410-2036

See introduction to this section for ordering information
*Indicates factory selected value



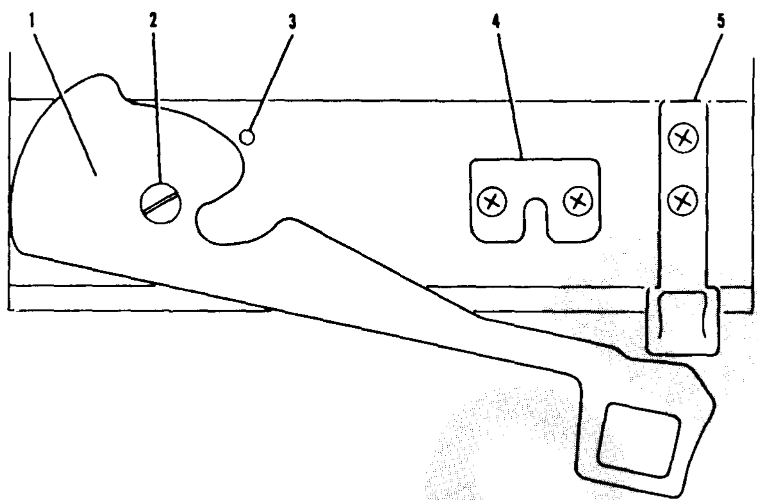
Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
1	5060-0267	4	1	COVER ASSY:TOP(OLIVE GRAY)	28480	5060-0267
	2370-0013	2	2	SCREW SST FLAT HD PHL DR 6-32X3/8	28480	2370-0013
2	08410-00056	4	1	PANEL, REAR (FAN SIDE)	28480	08410-00056
	2510-0046	9	1	SCREW-MACH 8-32 .375-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
	2510-0103	9	2	SCREW-MACH 8-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
3	08410-0028	0	1	PANEL, REAR, PLUG-IN SIDE	28480	08410-0028
	2510-0103	9		SCREW-MACH 8-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2190-0073	2	2	WASHER-LK HLCL NO. 8 .168-IN-ID	28480	2190-0073
	2360-0194	9	1	SCREW-MACH 6-32 .312-IN-LG 100 DEG	00000	ORDER BY DESCRIPTION
	2420-0001	5	1	NUT-HEX-W/LKWR 6-32-THD .109-IN-THK	00000	ORDER BY DESCRIPTION
4	08410-0029	2	1	COVER, REAR PANEL	28480	08410-0029
	3050-0083	9	1	WASHER-FL NM NO. 12 .25-IN-ID .5-IN-OD	28480	3050-0083
	2510-0099	2	1	SCREW-MACH 8-32 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2190-0009	4	1	WASHER-LK INTL T NO. 8 .168-IN-ID	28480	2190-0009
5	5060-8735	7	1	RETAINER HANDLE ASSY:OLIVE GRAY	28480	5060-8735
	2550-0013	4	1	SCREW-MACH 8-32 .312-IN-LG PAN-HD-PHL	00000	ORDER BY DESCRIPTION
	2190-0073	2		WASHER-LK HLCL NO. 8 .168-IN-ID	28480	2190-0073
6	5060-0222	1	1	HANDLE ASSY:5H SIDE	28480	5060-0222
7	5060-0232	3	1	FRAME ASSY:MODIFIED	28480	5060-0232
8	5000-0052	9	1	PLATE:FLUTED ALUMINUM	28480	5000-0052
9	5000-8719	1	1	COVER:SIDE 7 X 16(OLIVE GRAY)	28480	5000-8719
	2370-0020	1	2	SCREW-MACH 6-32 .188-IN-LG 100 DEG	00000	ORDER BY DESCRIPTION
10	5060-0268	5	1	COVER, BOTTOM, OLIVE GREY	28480	5060-0268
	2360-0013	1		SCREW-MACH 6-32 1-IN-LG RD-HD-SLT	00000	ORDER BY DESCRIPTION
11	1490-0030	6	1	TILT STAND 3-IN-W 13.75-IN-OA-LG SST	28480	1490-0030
12	5060-0767	9	5	FOOT ASSY:FM	28480	5060-0767
13	5060-8741	5	1	KIT:RACK MOUNT(GRAY)	28480	5060-8741
14	08410-00044	0	1	DECK, SLIDING (OLIVE GREY)	28480	08410-00044
	2360-0066	4	1	SCREW-MACH 6-32 .25-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
15				PANEL ASSY: FRONT, SEE FIG. 3-13.		
16	5000-8717	9	1	COVER:SIDE(OLIVE GRAY)	28480	5000-8717
	2370-0020	1		SCREW-MACH 6-32 .188-IN-LG 100 DEG	00000	ORDER BY DESCRIPTION
17	08410-2034	5	1	LEFT FRAME ASSY, MOD 7 X 16 FM	28480	08410-2034

Figure 6-1. Model 8410B Cabinet Parts



Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
				FIGURE 6-2, MODEL 8410B FRONT PANEL		
1	7120-1254	1	1	NAMEPLATE .312-IN-WD .54-IN-LG AL	28480	7120-1254
2	7120-4476	5	1	PLATE, IDENTIFICATION	28480	7120-4476
3	5020-3281	4	1	TRIM, NAMEPLATE	28480	5020-3281
4	08410-00061	1	1	PANEL, FRONT (MINT GREY)	28480	08410-00061
5	08410-2023	2	1	SUB-PANEL, FRONT	28480	08410-2023
	2370-0001	8	1	SCREW-MACH 6-32 .25-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
6	08410-2021	8	1	BRACKET, FRONT PANEL MTG (BOTTOM)	28480	08410-2021
	2370-0003	0	2	SCREW-MACH 6-32 .5-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
	0590-0305	9	2	NUT-HEX-W/LKWR 6-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
7	08410-2022	0	1	BRACKET, FRONT PANEL MTG, (TOP)	28480	08410-2022
	2370-0003	0		SCREW-MACH 6-32 .5-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
	0590-0305	9		NUT-HEX-W/LKWR 6-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
8	08410-20052	2	1	FRAME, UPPER (MINT GREY)	28480	08410-20052
	2530-0011	0	2	SCREW-MACH 8-32 .375-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
9	08410-20054	4	1	DIVIDERS FRAME SUPPORT (MINT GREY)	28480	08410-20054
	2210-0004	3	1	SCREW-MACH 4-40 .5-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
10	5020-7977	3	1	TRIM, UPPER FRAME (MINT GREY)	28480	5020-7977
11	08410-20053	3	1	FRAME, LOWER (MINT GREY)	28480	08410-20053
	2530-0011	0		SCREW-MACH 8-32 .375-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
	2530-0013	2	1	SCREW-MACH 8-32 .625-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
12	5020-7978	4	1	TRIM, LOWER FRAME (MINT GREY)	28480	5020-7978

Figure 6-2. Model 8410B Front Panel



Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
				FIGURE 6-3, 8410B EXTRACTOR-RETAINER PTS		
1	5020-3286	9	1	EXTRACTOR	28480	5020-3286
2	5020-3287	0	1	PIN, PIVOT	28480	5020-3287
3	08410-2027	0	1	PIN, STOP	28480	08410-2027
4	5020-3266	5	1	GUIDE, PLUG-IN	28480	5020-3266
	2360-0049	3	2	SCREW-MACH 6-32 .188-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
5	5040-0361	7	1	LOCK, EXTRACTOR, MINT GREY	28480	5040-0361
	2360-0049	3		SCREW-MACH 6-32 .188-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION

Figure 6-3. 8410B Extractor-Retainer Parts

Table 6-4. 8411A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1 (PREFIX 1824A	08411-80010	9	1	WIDEBAND SAMPLER ASSEMBLY (REF. CHANNEL)	28480	08411-80010
AND ABOVE)	08411-80012	1		REBUILT 08411-80010, REQUIRES EXCHANGE	28480	08411-80012
A1 (OPT.018,1824A	08411-80005	2		WIDEBAND SAMPLER ASSEMBLY (REF. CHANNEL)	28480	08411-80005
AND ABOVE)	08411-80007	4		REBUILT 08411-80005, REQUIRES EXCHANGE	28480	08411-80007
A1 (PREFIX 1726A	08411-80003	0		WIDEBAND SAMPLER ASSEMBLY (REF. CHANNEL)	28480	08411-80003
AND BELOW)	5080-0245	0		REBUILT 08411-80003, REQUIRES EXCHANGE	28480	5080-0245
A1 (OPT.018,1726A	08411-80102	0		WIDEBAND SAMPLER ASSEMBLY (REF. CHANNEL)	28480	08411-80102
AND BELOW)	5081-8123	1		REBUILT 08411-80102, REQUIRES EXCHANGE	28480	5081-8123
A1CR1				NOT SEPARATELY REPLACEABLE		
A1CR2				NOT SEPARATELY REPLACEABLE		
A1J1				NOT SEPARATELY REPLACEABLE		
A1J2				NOT SEPARATELY REPLACEABLE		
A1MP1	1250-0907	8	2	CONTACT-RF CONN SER APC-71 SPRING	02660	131-129
A1R1				NOT SEPARATELY REPLACEABLE		
A1R2				NOT SEPARATELY REPLACEABLE		
A1R3				LOAD CARTRIDGE, NSR		
A2 (PREFIX 1824A	08411-80011	0	1	WIDEBAND SAMPLER ASSEMBLY (TEST CHANNEL)	28480	08411-80011
AND ABOVE)	08411-80013	2		REBUILT 08411-80011, REQUIRES EXCHANGE	28480	08411-80013
A2 (OPT.018,1824A	08411-80006	3	1	WIDEBAND SAMPLER ASSEMBLY (TEST CHANNEL)	28480	08411-80006
AND ABOVE)	08411-80008	5		REBUILT 08411-80006, REQUIRES EXCHANGE	28480	08411-80008
A2 (PREFIX 1726A	08411-80004	1		WIDEBAND SAMPLER ASSEMBLY (TEST CHANNEL)	28480	08411-80004
AND BELOW)	5080-0246	1		REBUILT 08411-80004, REQUIRES EXCHANGE	28480	5080-0246
A2 (OPT.018,1726A	08411-80103	1		WIDEBAND SAMPLER ASSEMBLY (TEST CHANNEL)	28480	08411-80103
AND BELOW)	5081-8124	2		REBUILT 08411-80103, REQUIRES EXCHANGE	28480	5081-8124
A2CR1				NOT SEPARATELY REPLACEABLE		
A2CR2				NOT SEPARATELY REPLACEABLE		
A2J1				NOT SEPARATELY REPLACEABLE		
A2J2				NOT SEPARATELY REPLACEABLE		
A2MP1	1250-0907	8		CONTACT-RF CONN SER APC-71 SPRING	02660	131-129
A2R1				NOT SEPARATELY REPLACEABLE		
A2R2				NOT SEPARATELY REPLACEABLE		
A2R3				LOAD CARTRIDGE NSR		
A3	08411-6005	9	1	POWER AMPLIFIER ASSEMBLY	28480	08411-6005
A3C1				DELETED		
A3C2	0160-2516	7	10	CAPACITOR-STDOFF 1000PF GMV 1250V CER	01121	SB4A102
A3C3	0160-0345	6	10	CAPACITOR-FDTHRU 1000PF GMV 500V CER	01121	FB2B-102W
A3C4	0160-2516	7		CAPACITOR-STDOFF 1000PF GMV 1250V CER	01121	SB4A102
A3C5	0160-2516	7		CAPACITOR-STDOFF 1000PF GMV 1250V CER	01121	SB4A102
A3C6	0160-2140	3	11	CAPACITOR-FXD 470PF +80-20% 1KVDC CER	28480	0160-2140
A3C7	0160-2516	7		CAPACITOR-STDOFF 1000PF GMV 1250V CER	01121	SB4A102
A3C8	0160-2140	3		CAPACITOR-FXD 470PF +80-20% 1KVDC CER	28480	0160-2140
A3C9	0160-2516	7		CAPACITOR-STDOFF 1000PF GMV 1250V CER	01121	SB4A102
A3C10	0160-2140	3		CAPACITOR-FXD 470PF +80-20% 1KVDC CER	28480	0160-2140
A3C11	0160-2516	7		CAPACITOR-STDOFF 1000PF GMV 1250V CER	01121	SB4A102
A3C12	0160-2140	3		CAPACITOR-FXD 470PF +80-20% 1KVDC CER	28480	0160-2140
A3C13	0160-2516	7		CAPACITOR-STDOFF 1000PF GMV 1250V CER	01121	SB4A102
A3C14	0160-2516	7		CAPACITOR-STDOFF 1000PF GMV 1250V CER	01121	SB4A102
A3C15	0160-2516	7		CAPACITOR-STDOFF 1000PF GMV 1250V CER	01121	SB4A102
A3C16	0160-2516	7		CAPACITOR-STDOFF 1000PF GMV 1250V CER	01121	SB4A102
A3L1	9140-0120	2	1	COIL-MLD 100NH 20% Q=50 .155DX.375LG-NOM	28480	9140-0120
A3Q1	1854-0498	2	8	TRANSISTOR NPN SI TO-39 PD=1W	28480	1854-0498
A3Q2	1854-0498	2		TRANSISTOR NPN SI TO-39 PD=1W	28480	1854-0498
A3Q3	1854-0498	2		TRANSISTOR NPN SI TO-39 PD=1W	28480	1854-0498
A3Q4	1854-0498	2		TRANSISTOR NPN SI TO-39 PD=1W	28480	1854-0498
A3Q5	1854-0498	2		TRANSISTOR NPN SI TO-39 PD=1W	28480	1854-0498
A3Q6	1854-0498	2		TRANSISTOR NPN SI TO-39 PD=1W	28480	1854-0498
A3Q7	1854-0498	2		TRANSISTOR NPN SI TO-39 PD=1W	28480	1854-0498
A3R1				DELETED		
A3R2				DELETED		
A3R3	0757-0274	5	1	RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A3R4	0698-3696	5	2	RESISTOR 39 5% 1W MO TC=0+-200	27167	FP32-1-T00-39R0-J
A3R5	0698-3692	1	4	RESISTOR 27 5% 1W MO TC=0+-200	27167	FP32-1-T00-27R0-J
A3R6	0698-3692	1		RESISTOR 27 5% 1W MO TC=0+-200	27167	FP32-1-T00-27R0-J
A3R7	0698-3696	5		RESISTOR 39 5% 1W MO TC=0+-200	27167	FP32-1-T00-39R0-J
A3R8	0698-3692	1		RESISTOR 27 5% 1W MO TC=0+-200	27167	FP32-1-T00-27R0-J
A3R9	0698-3692	1		RESISTOR 27 5% 1W MO TC=0+-200	27167	FP32-1-T00-27R0-J
A3R10	0698-4848	1	2	RESISTOR 165 1% .5W F TC=0+-100	28480	0698-4848
A3R11	0698-4848	1		RESISTOR 165 1% .5W F TC=0+-100	28480	0698-4848
A3R12	0757-0804	7	2	RESISTOR 200 1% .5W F TC=0+-100	28480	0757-0804
A3R13	0757-0804	7		RESISTOR 200 1% .5W F TC=0+-100	28480	0757-0804

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-4. 8411A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A3Z1	9170-0016	8	24	CORE-SHIELDING BEAD	28480	9170-0016
A3Z2	9170-0016	8		CORE-SHIELDING BEAD	28480	9170-0016
A3Z3	08411-6009	7	6	COIL/CHOKE FERRITE	28480	08411-6009
A3Z4	9170-0016	8		CORE-SHIELDING BEAD	28480	9170-0016
A3Z5	9170-0016	8		CORE-SHIELDING BEAD	28480	9170-0016
A3Z6	9170-0016	8		CORE-SHIELDING BEAD	28480	9170-0016
A3Z7	9170-0016	8		CORE-SHIELDING BEAD	28480	9170-0016
A3Z8	08411-6009	7		COIL/CHOKE FERRITE	28480	08411-6009
A3Z9	9170-0016	8		CORE-SHIELDING BEAD	28480	9170-0016
A3Z10	9170-0016	8		CORE-SHIELDING BEAD	28480	9170-0016
A3Z11	08411-6009	7		COIL/CHOKE FERRITE	28480	08411-6009
A3Z12	9170-0016	8		CORE-SHIELDING BEAD	28480	9170-0016
A3Z13	9170-0016	8		CORE-SHIELDING BEAD	28480	9170-0016
A3Z14	9170-0016	8		CORE-SHIELDING BEAD	28480	9170-0016
A3Z15	08411-6009	7		COIL/CHOKE FERRITE	28480	08411-6009
A3Z16	9170-0016	8		CORE-SHIELDING BEAD	28480	9170-0016
A3Z17	9170-0016	8		CORE-SHIELDING BEAD	28480	9170-0016
A3Z18	9170-0016	8		CORE-SHIELDING BEAD	28480	9170-0016
A3Z19	08411-6009	7		COIL/CHOKE FERRITE	28480	08411-6009
A3Z20	9170-0016	8		CORE-SHIELDING BEAD	28480	9170-0016
A3Z21	9170-0016	8		CORE-SHIELDING BEAD	28480	9170-0016
A3Z22	08411-6009	7		COIL/CHOKE FERRITE	28480	08411-6009
A3Z23	9170-0016	8		CORE-SHIELDING BEAD	28480	9170-0016
A3Z24	9170-0016	8		CORE-SHIELDING BEAD	28480	9170-0016
A3Z25	9170-0016	8		CORE-SHIELDING BEAD	28480	9170-0016
A3Z26	9100-1791	1	1	COIL 290NH 20% .23DX.375LG-NOM	28480	9100-1791
A3Z27	9170-0016	8		CORE-SHIELDING BEAD	28480	9170-0016
A3Z28	9170-0016	8		CORE-SHIELDING BEAD	28480	9170-0016
A4	08411-6003	5	1	BOARD ASSEMBLY, REFERENCE PREAMP	28480	08411-6003
A4C1	0160-2055	9	22	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4C2	0140-0198	5	3	CAPACITOR-FXD 200PF +-5% 300VDC MICA	72136	DM15F201J0300WV1CR
A4C3	0140-0198	5		CAPACITOR-FXD 200PF +-5% 300VDC MICA	72136	DM15F201J0300WV1CR
A4C4	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4C5	0160-2253	9	1	CAPACITOR-FXD 6.8PF +-.25PF 500VDC CER	28480	0160-2253
A4C6	0160-2240	4	1	CAPACITOR-FXD 2PF +-.25PF 500VDC CER	28480	0160-2240
A4C7	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4C8	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4C9	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4C10	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4C11	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4C12	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4C13	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4C14	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4C15	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4C16	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4C17	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4L1	9140-0114	4	6	COIL-MLD 10UH 10% Q=55 .155DX.375LG-NOM	28480	9140-0114
A4L2	9100-2462	5	1	COIL-MLD 3.9UH 3% .156DX.375LG-NOM	28480	9100-2462
A4L3	9100-2446	5	1	COIL-MLD 10UH 10% Q=6.5 .175DX.425LG-NOM	28480	9100-2446
A4L4	9140-0114	4		COIL-MLD 10UH 10% Q=55 .155DX.375LG-NOM	28480	9140-0114
A4L5	9100-2463	6	1	COIL-MLD 6.8UH 3% .156DX.375LG-NOM	28480	9100-2463
A4Q1	1854-0073	9	5	TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0073
A4Q2	1853-0034	0	3	TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
A4Q3	1854-0073	9		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0073
A4Q4	1853-0034	0		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
A4Q5	1854-0073	9		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0073
A4R1	0698-3157	3	4	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A4R2	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A4R3	2100-1775	4	5	RESISTOR-TRMR 5K 5% WW TOP-ADJ 1-TRN	28480	2100-1775
A4R4	0698-3159	5	2	RESISTOR 26.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2612-F
A4R5	2100-1775	4		RESISTOR-TRMR 5K 5% WW TOP-ADJ 1-TRN	28480	2100-1775
A4R6	0698-3449	6	2	RESISTOR 28.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2872-F
A4R7	0757-0280	3	4	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4R8	0698-3161	9	2	RESISTOR 38.3K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3832-F
A4R9	0757-0458	7	2	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A4R10	0698-3440	7	7	RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A4R11	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A4R12	0698-3153	9	4	RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A4R13	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A4R14*	0757-0401	0	2	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A4R15	0698-3430	5		RESISTOR 21.5 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21R5-F
A4R16	0757-0438	3	4	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A4R17	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A4R18	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A4R19	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A4R20	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-4. 8411A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4R21*	0757-0403	2	1	RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
A4R22	0757-0417	8	2	RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F
A4R23	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A4R24	0698-3441	8	1	RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A4R25	0698-3430	5		RESISTOR 21.5 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21R5-F
A4R26	0698-0085	0	2	RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F
A4R27	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A4Z1	9170-0016	8		CORE-SHIELDING BEAD	28480	9170-0016
A5	08411-6004	7	1	BOARD ASSEMBLY, TEST PREAMP	28480	08411-6004
A5C1	0160-2261	9	1	CAPACITOR-FXD 15PF +-5% 500VDC CER 0+-30	28480	0160-2261
A5C2*	0160-2308	5	1	CAPACITOR-FXD 36PF +-5% 300VDC MICA	28480	0160-2308
A5C3	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C4				NOT ASSIGNED		
A5C5	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C6	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C7	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C8	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C9	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C10	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C11	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C12	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C13	0130-0017	6	1	CAPACITOR-V TRMR-CER 8-50PF 350V PC-MTG	28480	0130-0017
A5L1	9140-0111	1	1	COIL-MLD 3.3UH 10% Q=33 .155DX.375LG-NOM	28480	9140-0111
A5L2	9140-0114	4		COIL-MLD 10UH 10% Q=55 .155DX.375LG-NOM	28480	9140-0114
A5L3	9140-0114	4		COIL-MLD 10UH 10% Q=55 .155DX.375LG-NOM	28480	9140-0114
A5Q1	1854-0073	9		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0073
A5Q2	1853-0034	0		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
A5Q3	1854-0073	9		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0073
A5R1	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A5R2	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A5R3	2100-1775	4		RESISTOR-TRMR 5K 5% WW TOP-ADJ 1-TRN	28480	2100-1775
A5R4	0698-3159	5		RESISTOR 26.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2612-F
A5R5	2100-1775	4		RESISTOR-TRMR 5K 5% WW TOP-ADJ 1-TRN	28480	2100-1775
A5R6	0698-3449	6		RESISTOR 28.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2872-F
A5R7	0757-0317	7	1	RESISTOR 1.33K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1331-F
A5R8*	0698-3443	0	1	RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A5R9	0757-0458	7		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A5R10	0757-0417	8		RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F
A5R11	0698-3161	9		RESISTOR 38.3K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3832-F
A5R12	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A5R13	0757-0416	7	2	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A5R14	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A5R15	0698-0085	0		RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F
A5R16	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A5R17	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A5R18				NOT ASSIGNED		
A5R19*	0698-3430	5	3	RESISTOR 21.5 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21R5-F
A5R20	2100-1776	5	1	RESISTOR-TRMR 10K 5% WW TOP-ADJ 1-TRN	28480	2100-1776
A5R21	2100-1774	3	3	RESISTOR-TRMR 2K 5% WW TOP-ADJ 1-TRN	28480	2100-1774
A6	08411-6001	1	1	BOARD ASSEMBLY, SHAPING AMPLIFIER	28480	08411-6001
A6C1	0180-0100	3	3	CAPACITOR-FXD 4.7UF+-10% 35VDC TA	56289	150D475X9035B2
A6C2	0180-0100	3		CAPACITOR-FXD 4.7UF+-10% 35VDC TA	56289	150D475X9035B2
A6C3	0160-0158	9	1	CAPACITOR-FXD 5600PF +-10% 200VDC POLYE	28480	0160-0158
A6C4	0140-0198	5		CAPACITOR-FXD 200PF +-5% 300VDC MICA	72136	DM15F201J0300WV1CR
A6C5	0180-0100	3		CAPACITOR-FXD 4.7UF+-10% 35VDC TA	56289	150D475X9035B2
A6CR1	1902-0791	1	1	DIODE-ZNR 1N942 11.7V 5% DO-7 PD=.5W	24046	1N942
A6CR2	1901-0025	2	5	DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A6CR3	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A6CR4	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A6CR5	1910-0016	0	3	DIODE-GE 60V 60MA 1US DO-7	28480	1910-0016
A6CR6	1910-0016	0		DIODE-GE 60V 60MA 1US DO-7	28480	1910-0016
A6CR7	1910-0016	0		DIODE-GE 60V 60MA 1US DO-7	28480	1910-0016
A6CR8	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A6L1	9100-1612	5	1	COIL-MLD 330NH 20% Q=45 .155DX.375LG-NOM	28480	9100-1612
A6Q1	1853-0012	4	1	TRANSISTOR PNP 2N2904A SI TO-39 PD=600MW	01295	2N2904A
A6R1	0698-3401	0	1	RESISTOR 215 1% .5W F TC=0+-100	28480	0698-3401
A6R2	2100-1769	6	1	RESISTOR-TRMR 50 5% WW TOP-ADJ 1-TRN	28480	2100-1769
A6R3	0757-0382	6	2	RESISTOR 16.2 1% .125W F TC=0+-100	19701	MF4C1/8-T0-16R2-F
A6R4	0757-0382	6		RESISTOR 16.2 1% .125W F TC=0+-100	19701	MF4C1/8-T0-16R2-F
A6R5	0698-3402	1	1	RESISTOR 316 1% .5W F TC=0+-100	28480	0698-3402

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-4. 8411A Replaceable Parts

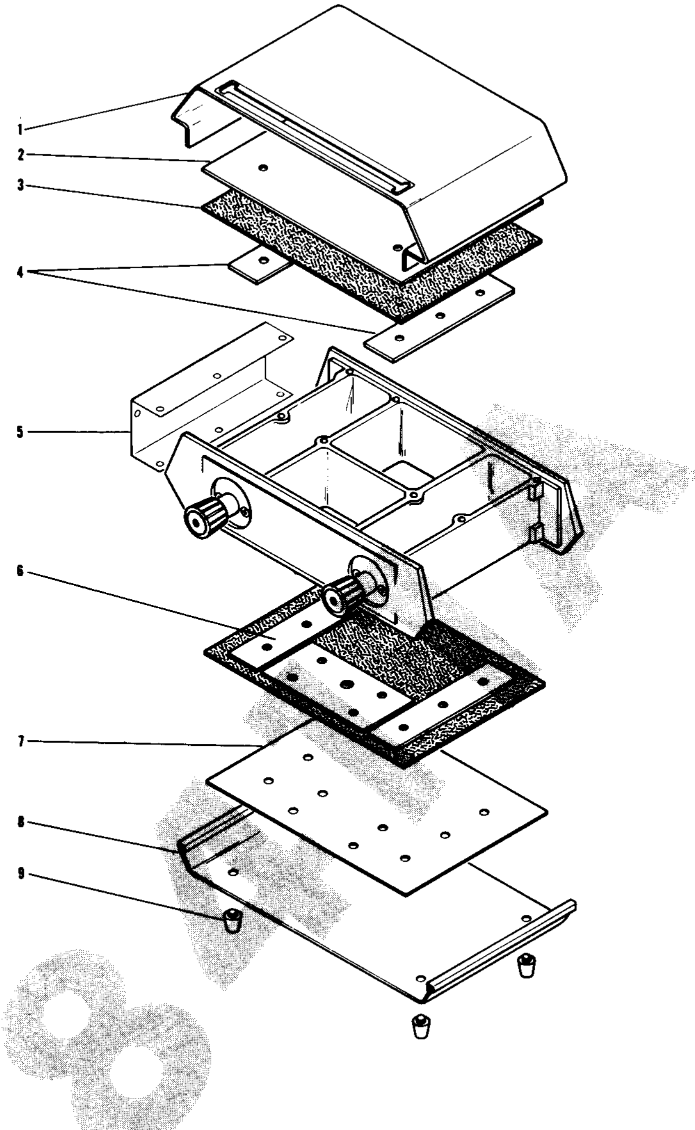
Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6R6	2100-1773	2	2	RESISTOR-TRMR 1K 5% WW TOP-ADJ 1-TRN	28480	2100-1773
A6R7	2100-1774	3		RESISTOR-TRMR 2K 5% WW TOP-ADJ 1-TRN	28480	2100-1774
A6R8	2100-1775	4		RESISTOR-TRMR 5K 5% WW TOP-ADJ 1-TRN	28480	2100-1775
A6R9	0698-3447	4	3	RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A6R10	0757-0279	0	3	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A6R11	0757-0288	1	1	RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A6R12	0757-0400	9	1	RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A6R13	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A6R14	2100-1773	2		RESISTOR-TRMR 1K 5% WW TOP-ADJ 1-TRN	28480	2100-1773
A6R15	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A6R16	2100-1774	3		RESISTOR-TRMR 2K 5% WW TOP-ADJ 1-TRN	28480	2100-1774
A7	08411-6024	9	1	BOARD ASSEMBLY, VTO	28480	08411-6024
A7C1	0180-1743	2	1	CAPACITOR-FXD .1UF+-10% 35VDC TA	56289	150D104X9035A2
A7C2	0160-3455	5		CAPACITOR-FXD 470PF +80-20% 1KVDC CER	28480	0160-3455
A7C3	0160-3455	5		CAPACITOR-FXD 470PF +80-20% 1KVDC CER	28480	0160-3455
A7C4	0160-4299	7	2	CAPACITOR-FXD 2000PF +80-20% 1KVDC CER	28480	0160-4299
A7C5	0160-4299	7		CAPACITOR-FXD 2000PF +80-20% 1KVDC CER	28480	0160-4299
A7C6	0180-0116	1	2	CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A7C7	0180-0116	1		CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A7C8	0160-3455	5		CAPACITOR-FXD 470PF +80-20% 1KVDC CER	28480	0160-3455
A7C9	0160-3455	5		CAPACITOR-FXD 470PF +80-20% 1KVDC CER	28480	0160-3455
A7C10	0160-3455	5		CAPACITOR-FXD 470PF +80-20% 1KVDC CER	28480	0160-3455
A7C11	0160-3455	5		CAPACITOR-FXD 470PF +80-20% 1KVDC CER	28480	0160-3455
A7C12	0160-3455	5		CAPACITOR-FXD 470PF +80-20% 1KVDC CER	28480	0160-3455
A7C13*	0160-2198	1	1	CAPACITOR-FXD 20PF +-5% 300VDC MICA	28480	0160-2198
A7C14	0160-3454	4	3	CAPACITOR-FXD 220PF +80-20% 1KVDC CER	28480	0160-3454
A7C15	0160-3454	4		CAPACITOR-FXD 220PF +80-20% 1KVDC CER	28480	0160-3454
A7C16	0160-3454	4		CAPACITOR-FXD 220PF +80-20% 1KVDC CER	28480	0160-3454
A7CR1	0122-0038	4	2	DIODE-VVC 20PF 5% C4/C25-MIN=2.071	28480	0122-0038
A7CR2	0122-0038	4		DIODE-VVC 20PF 5% C4/C25-MIN=2.071	28480	0122-0038
A7CR3	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A7CR4				NOT ASSIGNED		
A7CR5	1901-0044	5	1	DIODE-SWITCHING 50V 50MA 6NS	28480	1901-0044
A7CR6	1901-0047	8	1	DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A7Q1	1854-0323	2	2	TRANSISTOR NPN 2N2857 SI TO-72 PD=200MW	0192B	2N2857
A7Q2	1854-0323	2		TRANSISTOR NPN 2N2857 SI TO-72 PD=200MW	0192B	2N2857
A7Q3	1854-0262	8	1	TRANSISTOR NPN SI TO-18 PD=200MW	28480	1854-0262
A7Q4	1854-0498	2		TRANSISTOR NPN SI TO-39 PD=1W	28480	1854-0498
A7Q5	1854-0071	7	1	TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A7R1	0698-3429	2	1	RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
A7R2	0698-7253	8	1	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A7R3	0698-7248	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A7R4	0698-0084	9	1	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A7R5	2100-1772	1	1	RESISTOR-TRMR 500 5% WW TOP-ADJ 1-TRN	28480	2100-1772
A7R6	0757-0424	7	1	RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
A7R7	0698-3447	4		RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A7R8	0699-0110	4	2	RESISTOR 90.9 1% .125W F TC=0+-100	28480	0699-0110
A7R9	0698-3407	6	2	RESISTOR 1.96K 1% .5W F TC=0+-100	28480	0698-3407
A7R10	0698-0083	8	1	RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A7R11	0699-0110	4		RESISTOR 90.9 1% .125W F TC=0+-100	28480	0699-0110
A7R12	0698-3407	6		RESISTOR 1.96K 1% .5W F TC=0+-100	28480	0698-3407
A7R13	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A7R14	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A7R15	0757-0317	7		RESISTOR13301% .125W F TC=0+-100	24546	C4-1/8-T0-1331-F
A7R16	0757-0419	0	1	RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A7R17	0760-0024	0	1	RESISTOR 100 5% 1W MO TC=0+-200	28480	0760-0024
A7R18	0757-0796	6	1	RESISTOR 82.5 1% .5W F TC=0+-100	28480	0757-0796
A7R19	2100-1775	4	1	RESISTOR-TRMR 5K 5% WW TOP-ADJ 1-TRN	28480	2100-1775
A7R20	0698-3447	4		RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A7R21	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A7R22	0698-7264	1		RESISTOR 14.7K 1% .125W F TC=0 +-100	24546	C4-1/8-T0-1472-F
A7Z1	08411-6008	5	4	CHOKE, FERRITE	28480	08411-6008
A7Z2	08411-6008	5		CHOKE, FERRITE	28480	08411-6008
A7Z3	08411-6008	5		CHOKE, FERRITE	28480	08411-6008
A7Z4	08411-6008	5		CHOKE, FERRITE	28480	08411-6008
A7Z5	9170-0016	8		CORE-SHIELDING BEAD	28480	9170-0016
A7Z6	9100-1788	6	2	CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK200 20/4B
A7Z7	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK200 20/4B
				CHASSIS PARTS		
C1				NOT SEPARATELY REPLACEABLE		
C2	0160-0345	6		CAPACITOR-FDTHRU 1000PF GMV 500V CER	01121	FB2B-102W
C3	0160-0345	6		CAPACITOR-FDTHRU 1000PF GMV 500V CER	01121	FB2B-102W

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-4. 8411A Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
C4	0160-0345	6		CAPACITOR-FDTHRU 1000PF GMV 500V CER	01121	FB2B-102W
C5	0160-0345	6		CAPACITOR-FDTHRU 1000PF GMV 500V CER	01121	FB2B-102W
C6	0160-0345	6		CAPACITOR-FDTHRU 1000PF GMV 500V CER	01121	FB2B-102W
C7	0160-0345	6		CAPACITOR-FDTHRU 1000PF GMV 500V CER	01121	FB2B-102W
C8	0160-0345	6		CAPACITOR-FDTHRU 1000PF GMV 500V CER	01121	FB2B-102W
C9	0160-0345	6		CAPACITOR-FDTHRU 1000PF GMV 500V CER	01121	FB2B-102W
C10	0160-0345	6		CAPACITOR-FDTHRU 1000PF GMV 500V CER	01121	FB2B-102W
CR1	1901-0349	3	1	DIODE	28480	1901-0349
L1				NOT SEPARATELY REPLACEABLE		
L2				NOT SEPARATELY REPLACEABLE		
L3	9140-0114	4		COIL-MLD 10UH 10% Q=55 .155DX.375LG-NOM	28480	9140-0114
L4	9140-0114	4		COIL-MLD 10UH 10% Q=55 .155DX.375LG-NOM	28480	9140-0114
P1	1250-0260	6	4	CONT-RF CONN SUBMIN SERIES	28480	1250-0260
P2	1250-0260	6		CONT-RF CONN SUBMIN SERIES	28480	1250-0260
P3	1250-0260	6		CONT-RF CONN SUBMIN SERIES	28480	1250-0260
P4	1250-0260	6		CONT-RF CONN SUBMIN SERIES	28480	1250-0260
R1				NOT SEPARATELY REPLACEABLE		
R2				NOT SEPARATELY REPLACEABLE		
R3				NOT SEPARATELY REPLACEABLE		
W1	08411-6006	1	1	INTERCONNECT CABLE ASSEMBLY, COMPLETE	28480	08411-6006
W1P1				NOT SEPARATELY REPLACEABLE		
Z1	9170-0016	8		CORE-SHIELDING BEAD	28480	9170-0016
Z2	9170-1045	5	1	CORE-SHIELDING BEAD	28480	9170-1045

See introduction to this section for ordering information
*Indicates factory selected value



Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
				FIGURE 6-4, MODEL 8411A CABINET PARTS		
1	08411-00013	4	1	COVER, TOP (OLIVE GREY)	28480	08411-00013
2	08411-0005	3	1	COVER, RFI TOP	28480	08411-0005
3	08411-0010	4	1	GASKET, RFI	28480	08411-0010
4	08411-4002	1	1	ABSORBER, RF-LONG	28480	08411-4002
5	08411-00016	7	1	SHIELD, TEST PREAMP	28480	08411-00016
5	08411-00017	8	1	SHIELD, REF PREAMP	28480	08411-00017
6	08411-4001	9	1	ABSORBER, RF-SHORT	28480	08411-4001
7	08411-0004	1	1	COVER, RFI BOTTOM	28480	08411-0004
8	08411-00014	5	1	COVER, BOTTOM (OLIVE GREY)	28480	08411-00014
9	08411-4003	3	4	FOOT	28480	08411-4003

Figure 6-4. Model 8411A Cabinet Parts

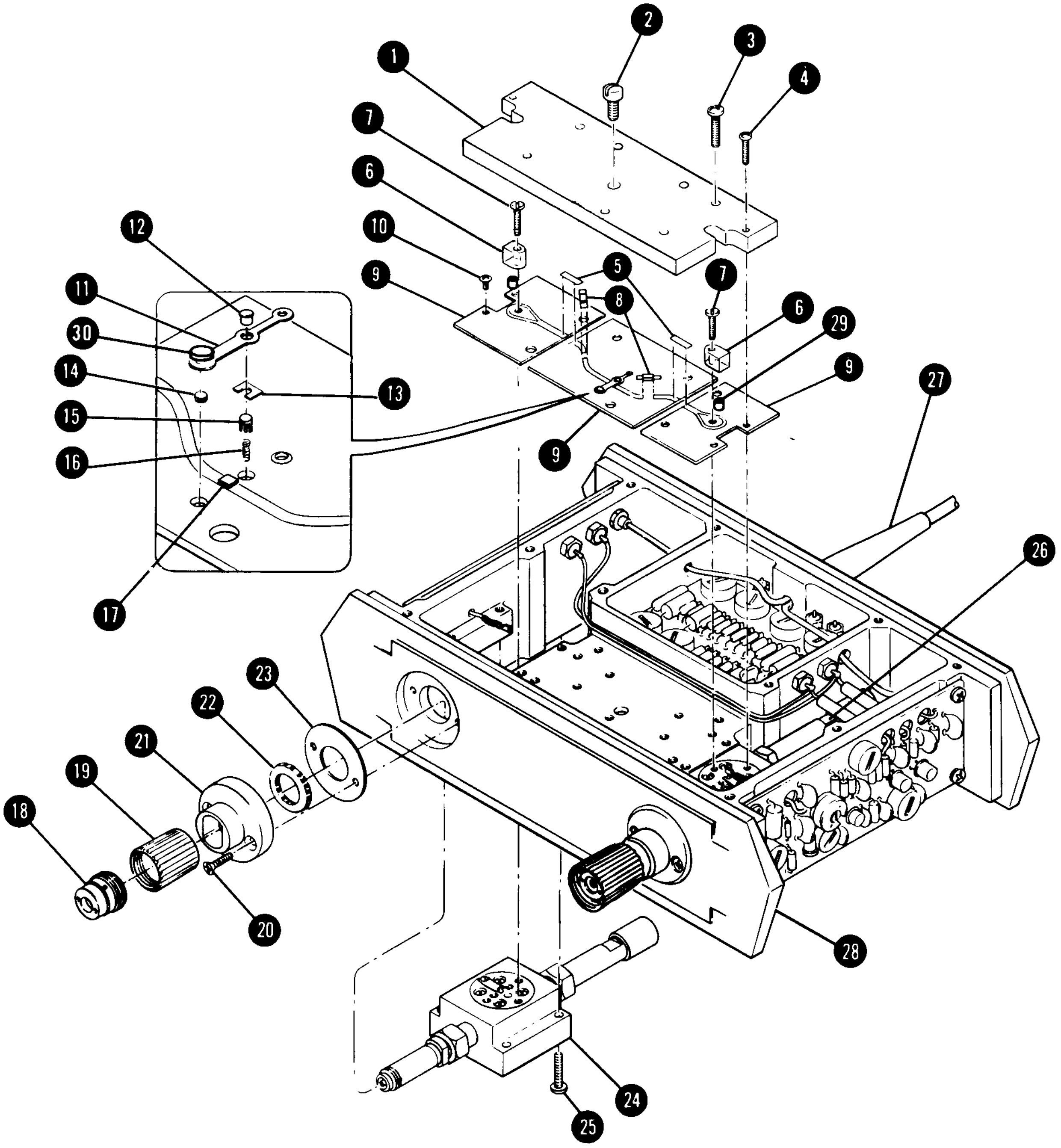


Figure 6-5. Model 8411A Exploded View (1 of 2)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
1	08411-20031	8	1	COVER, STRIPLINE	28480	08411-20031
2	2510-0140	4	1	SCREW-MACH 8-32 .25-IN-LG FIL-HD-SLT	00000	ORDER BY DESCRIPTION
3	2360-0119	8	1	SCREW-MACH 6-32 .438-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
4	0520-0130	1	2	SCREW-MACH 2-56 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
5	08411-00015	6	1	JUMPER, STRIPLINE (SEE ITEM 9 FOR DESC.)	28480	08411-00015
6	08411-2026	9	1	CLAMP, MIXER COAX (INCL SUPPRESSOR BEAD)	28480	08411-2026
7	0520-0093	5	1	SCREW-MACH 2-56 .375-IN-LG BDG-HD-SLT	00000	ORDER BY DESCRIPTION
8	0698-7195	7	1	RESISTOR 19.6 1% .05W F TC=0+-100	24546	C3-1/8-T00-19R6-G
				NOTE THIS RESISTOR IS BEING USED AS A TEMPORARY MEASURE UNTIL A MORE SUITABLE REPLACEMENT IS AVAILABLE. WHEN REPLACING THESE RESISTORS, ORDER BY MODEL NUMBER AND REFERENCE DESIGNATOR TO OBTAIN THE MOST RECENT RESISTORS AVAILABLE.		
9	08411-60029	8	1	STRIPLINE ASSEMBLY, END SECTION +5,8, 17	28480	08411-60029
10	0520-0130	1		SCREW-MACH 2-56 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
11	08411-2021	9	1	CONTACT, STEP RECOVERY DIODE	28480	08411-2021
12	1901-0349	3	1	DIODE	28480	1901-0349
13	1530-0976	7	1	SHIM HP	28480	1530-0978
14	0698-5679	8	1	RESISTOR 20 10% .1W C TC=0+-300	28480	0698-5679
15	08411-2014	4	1	CONTACT, SLIDING	28480	08411-2014
16	1460-0268	9	1	SPRING-CPRSN .062-IN-OD .125-IN-OA-LG	28480	1460-0268
17	0160-3854	8	1	CAPACITOR-FXD 500PF100VDC CER	28480	0160-3854
18	1250-0820	4	1	RETAINER-RF CONN RTNR ASSY FOR	02660	131-131
19	1250-0819	1	1	NUT-RF CONN SERIES APC-7I COUPLING	02660	131-126
	2200-0057	5	1	SCREW-MACH 4-40 .5-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
	0624-0203	9	1	SCREW-TPG 4-40 .375-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
21	08411-2018	2	1	COVER, RFI FRONT	28480	08411-2018
22	8160-0074	6	1	RFI RING BRS AG-PL .75-IN-OD .5-IN-ID	28480	8160-0074
23	08411-2011	8	1	SHIELD, PREAMP	28480	08411-2011
24	08411-80010	9	1	WIDEBAND SAMPLER ASSY (REF. CHANNEL)	28480	08411-80010
		1	1	(SEE 8411A-A1 FOR COMPLETE LISTING)		
25	2360-0123	4	1	SCREW-MACH 6-32 .625-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
26	08411-80011	0	1	WIDEBANDSAMPLER ASSY (TEST CHANNEL)	28480	08411-80011
		2	1	(SEE 8411A-A2 FOR COMPLETE LISTING)		
27	08411-6013	6	1	INTERCONNECT CABLE ASSY, COMPLETE	28480	08411-6013
28	08411-20028	3	1	HOUSING	28480	08411-20028

Figure 6-5. Model 8411A Exploded View (2 of 2)

Table 6-5. Code List of Manufacturers

Mfr. No.	Manufacturer Name	Address	Zip Code
00000	ANY SATISFACTORY SUPPLIER		
0046G	NORELCO NORTH AMER PHILIPS LTG CORP	LOS ANGELES, CA	90021
00853	SANGAMO ELEC CO S CAROLINA DIV	PICKENS, SC	29671
01121	ALLEN-BRADLEY CO	MILWAUKEE, WI	53204
01295	TEXAS INSTR INC SEMICOND CMPNT DIV	DALLAS, TX	75222
0192B	RCA CORP SOLID STATE DIV	SOMERVILLE, NJ	08876
02111	SPECTROL ELECTRONICS CORP	CITY OF IND, CA	91745
02114	FERROXCUBE CORP	SAUGERTIES, NY	12477
02660	AMPHENOL SALES DIV OF BUNKER-RAMO	BROADVIEW, IL	60153
03888	KDI PYROFILM CORP	WHIPPANY, NJ	07981
04213	CADDELL-BURNS MFG CO INC	MINEOLA, NY	11501
04713	MOTOROLA SEMICONDUCTOR PRODUCTS	PHOENIX, AZ	85062
09922	BURNDY CORP	NORWALK, CT	06852
19701	MEPCO/ELECTRA CORP	MINERAL WELLS, TX	76067
20940	MICRO-OHM CORP	EL MONTE, CA	91731
24046	TRANSITRON ELECTRONIC CORP	WAKEFIELD, MA	01880
24546	CORNING GLASS WORKS (BRADFORD)	BRADFORD, PA	16701
27167	CORNING GLASS WORKS (WILMINGTON)	WILMINGTON, NC	28401
28480	HEWLETT-PACKARD CO CORPORATE HQ	PALO ALTO, CA	94304
30983	MEPCO/ELECTRA CORP	SAN DIEGO, CA	92121
52763	STETTNER-TRUSH INC	CAZENOVIA, NY	13035
56289	SPRAGUE ELECTRIC CO	NORTH ADAMS, MA	01247
72136	ELECTRO MOTIVE CORP SUB IEC	WILLIMANTIC, CT	06226
75042	TRW INC PHILADELPHIA DIV	PHILADELPHIA, PA	19108

SECTION VII
MANUAL CHANGES

7-1. INTRODUCTION

7-2. This section contains instructions for adapting this Operating and Service Manual to instruments with serial prefixes different from the ones listed on the title page of this manual.

7-3. MANUAL CHANGES

7-4. To adapt this manual to your 8410B or 8411A, refer to Table 7-1 and make all the changes listed opposite the serial number of your instrument. (The serial number plate is on the instrument's rear panel.) Perform all the indicated changes in the order in which they are listed.

7-5. If your instrument's serial number, or serial number prefix, is not listed on the title page of this manual or in Table 7-1, it may be documented in a yellow MANUAL CHANGES supplement. For additional information about serial number coverage refer to INSTRUMENTS COVERED BY MANUAL in Section I.

Table 7-1. Manual Changes By Serial Number

SERIAL PREFIX OR NUMBER	MAKE MANUAL CHANGES
8410A	
1450A, 1525A00191 thru 1525A00302	A, B, C, D, E
1525A00303 thru 1525A prefix	A, B, C, D
1647A	A, B, C
1734A, 1741A prefix thru 1741A01370	A, B
1741A01371 thru 1741A Prefix	A

SERIAL PREFIX OR NUMBER	MAKE MANUAL CHANGES
8411A	
803-	F thru N
821-	F thru M
850-	F thru L
905-	F thru K
930-	F thru J
0934A	F, G, H, I
1144A	F, G, H
1644A, 1726A	F, G
1824A	F

CHANGE A

Table 6-3:
Delete A10Fl, A10MP1, and A10MP2.

Figure 8-62:
Delete fuse F1 and connect jumper wire where fuse was connected.

CHANGE B

Table 6-3:
Change A10A1C6 to HP Part Number 0160-4300, Capacitor-FXD 0.05 UF +80 − 20% 100 VDCW

Figure 8-62:
Change A10A1C6 to 0.05 UF.

CHANGE C

Table 6-3:

Change A7R10 to HP Part Number 2100-0942, R:VAR FLM 50K OHM 20% 3/4 W.

Change A10A1C3 to HP Part Number 0160-2917.

Change A10A1C6 to HP Part Number 0160-2917.

Change A11C1 to HP Part Number 0160-0134, C:FXD MICA 220 PF 5% 300 VDCW. Factory selected part.

Add A11C5, HP Part No. 0160-0939, C:FXD MICA 430 PF 5% 300 VDCW.

Change A11C7 to HP Part Number 0160-2207, C:FXD MICA 300 PF 5%.

Figure 8-48:

Change the value of A11C1* to 220 PF.

Remove asterisk (*) from A11C4.

Add A11C5, 430PF, in parallel with A11C4.

Change the value of A11C7* to 300 PF.

CHANGE D

Table 6-3:

Add A10A1C2, HP Part Number 0160-2917, C:FXD CER 0.05 UF +80 − 20% 100 VDCW.

Add A10A1C4, HP Part Number 0180-0291, C:FXD ELECT 1.0 UF 10% 35 VDCW.

Add A10A1C7, HP Part Number 0160-2917, C:FXD CER 0.05 UF +80 − 20% 100 VDCW.

Add A10A1R7, HP Part Number 0757-0346, R:FXD MET FLM 10 OHM 1% 1/8 W.

Add A10A1R17, HP Part Number 0683-0275, R:FXD COMP 2.7 OHM 5% 1/4 W.

Add A10A1R28, HP Part Number 0757-0346, R:FXD MET FLM 10 OHM 1% 1/8 W.

Delete A10A1C9, A10A1C10, and A10A1C11.

Figure 8-59:

Replace capacitor A10A1C9 with series RC circuit A10A1R7 (10Ω) and A10A1C2 (0.05 UF).

Replace capacitor A10A1C10 with series RC circuit A10A1R17 (2.7Ω) and A10A1C4 (1.0 UF).

CHANGE D (Cont'd)

Figure 8-61:
Replace the Parts Location Drawing of A10A1 with the one in Figure 7-1.

Figure 8-62:
Replace capacitor A10A1C11 with series RC circuit A10A1R28 (10Ω) and A10A1C7 (0.05 UF).

CHANGE E

Table 6-3:
Delete A12Z2

Delete A14Z2

Figure 8-36:
Delete A12Z2

Delete A14Z2

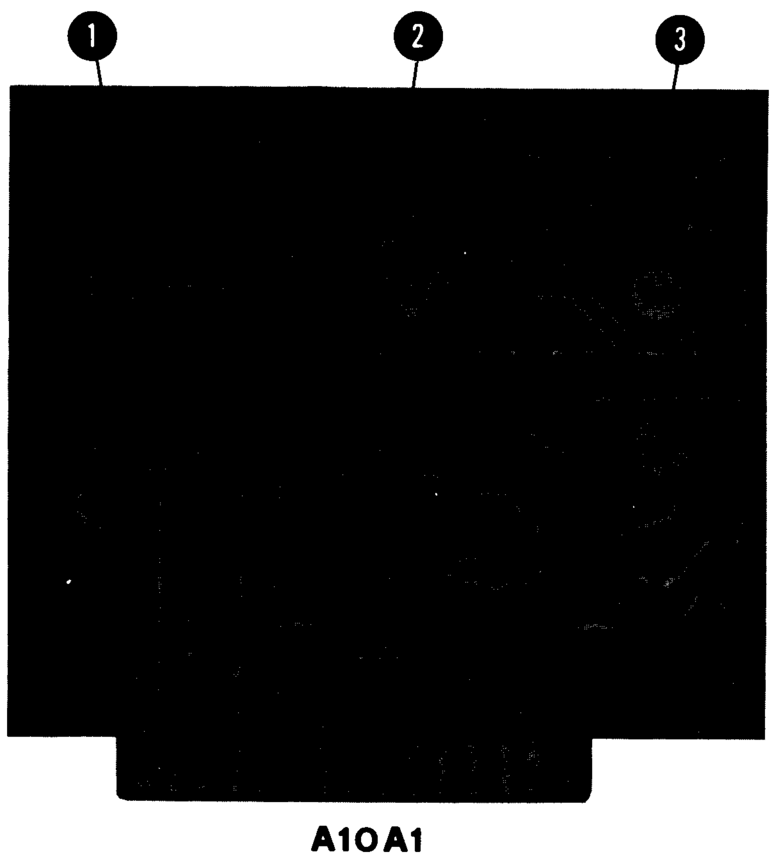


Figure 7-1. (Figure 3-80. 8410A-A10A1 Parts Location (Change D)

CHANGE F

Table 6-4:

Change A7C2, A7C3, A7C8, and A7C9 through A7C12 to HP Part number 0160-2140.

Change A7C4 and A7C5 to HP Part Number 0160-2143.

Change A7C14 through A7C16 to HP Part Number 0160-2139.

Change A7R2 to HP Part Number 0757-0200, 5620 Ohms.

Change A7R3 to HP Part Number 0757-0279.

Change A7R15 to HP Part Number 0757-0280, 1000 Ohms.

Change A7R19 to HP Part Number 2100-1777, 20K Ohms.

Delete A7R22.

Figure 8-33:

Change A7R19 to 20 K Ohms.

Change A7R2 to 5620 Ohms.

Delete A7R22.

Change A7 VTO Assembly LOW Frequency Clamp Circuit as shown in Figure 7-2.

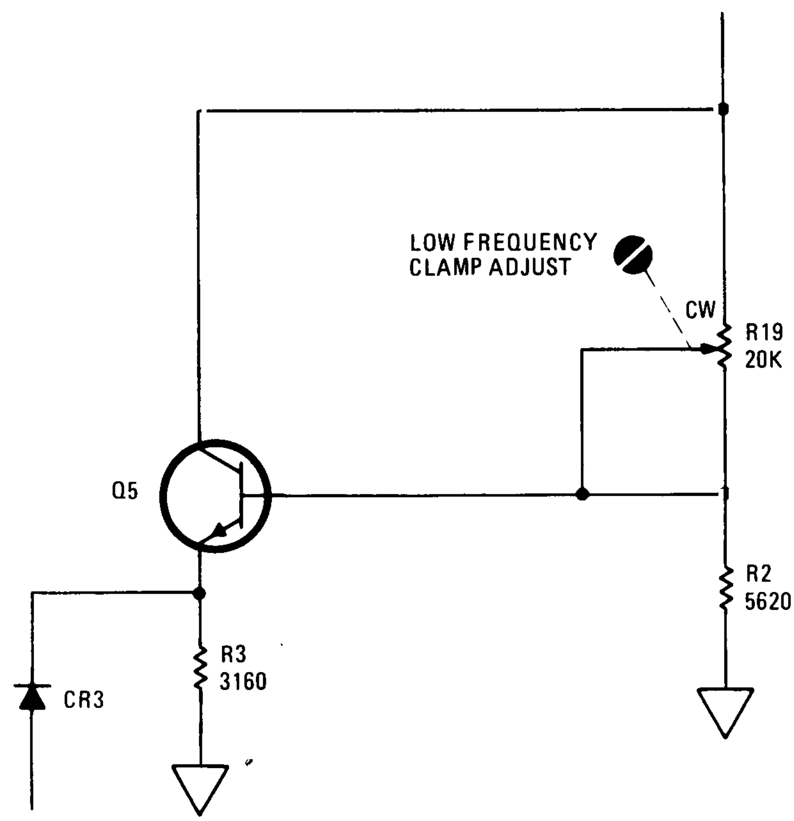


Figure 7-2. (P/O Figure 8-33) 8411A-A6 and A7, Schematic Diagram (CHANGE F)

CHANGE G

Table 1-1:
Change 8411A Input Impedance specification to: 50 Ohms nominal. SWR <1.5:1, 0.11 to 8.0 GHz; <2:1, 8.0 to 12.4 GHz; typically increases to a 10:1 SWR, 12.4 to 18 GHz

Paragraph 4-18:
Under "SPECIFICATION TESTED", change Input Impedance to: 50 Ohms; SWR <1.5:1, 0.11 to 8.0 GHz; <2:1, 8.0 to 12.4 GHz.

Change step f to read as follows:

f. SWR meter should indicate (a) at least 12.7 dB below zero dB reference level (or SWR of 1.6) at a frequency of 0.11 to 8.0 GHz, or (b) at least −8.7 dB below zero dB reference level (or SWR of 2.2) at a frequency of 8.0 to 12.4 GHz. (These test limits include ambiguity due to 30 dB directivity in reflection test unit or directional coupler.)

Change step h to read as follows:

h. SWR meter should indicate (a) at least 12.7 dB below zero dB reference level at a frequency of 0.11 to 8.0 GHz, or (b) at least −8.7 dB below zero dB reference level at a frequency of 8.0 to 12.4 GHz. (These test limits include ambiguity due to 30 dB directivity in reflection test unit or directional coupler.)

Table 6-4:
Change 8411A-A1 to HP Part Number 08411-80003; Wideband Sampler Assy. (Ref. channel).

Change second entry for 8411A-A1 to: HP Part Number 5080-0245 (Rebuilt 08411-80003, exchange required).

Change 8411A-A2 to HP Part Number 08411-80004; Wideband Sampler Assy. (Test Channel).

Change second entry for 8411A-A2 to: HP Part Number 5080-0246 (Rebuilt 08411-80004, exchange required).

In the list of callouts for figure 6-4, change item 5 to read: 08411-0011, SHIELD: PREAMP.

In the list of callouts for Figure 6-5, change the following items to read:
Item 24, 08411-80003, Wideband Sampler Assy. (Ref. Channel)
5080-0245, Rebuilt 08411-80003, Requires Exchange.

Item 26, 08411-80004, Wideband Sampler Assy. (Test Channel).
5080-0246, Rebuilt 08411-80004, Requires Exchange.

CHANGE H

Table 6-4:
Add A3R1, HP Part Number 0757-0796, R:FXD MET FLM 82.5 OHM 1% 1/2 W.

Add A3R2, HP Part Number 0757-0198, R:FXD MET FLM 100 OHM 1% 1/2 W.

Delete A3R10 through A3R13.

Figure 8-27:
Replace R10 and R11 in parallel with a single 82.5 Ohm resistor R1.

Replace R12 and R13 in parallel with a single 100 Ohm resistor R2.

CHANGE I

Table 6-4:

In the list of callouts for Figure 6-5, change Item 8 to: HP Part Number 0698-8138, R:FXD ALUMINA-CER 20 OHM 10% 0.075W (See #9); Order recommended replacement, 0698-7195.

CHANGE J

Table 6-4:

Delete Z2, HP Part Number 9170-1045 listing.

Change item 27 to HP Part Number 08411-6006 INTERCONNECT CABLE ASSY: COMPLETE

Change Item 28 to HP Part Number 08411-2022 HOUSING.

Figure 8-33.

Replace Figure 8-33 A7 Schematic Diagram in the manual with Figure 7-3 in this Section.

CHANGE K

Table 6-4

In the listing for Figure 6-5, add to the description of Reference Designator 6: "RECOMMENDED REPLACEMENT"

The coaxial clamp on your instrument may not have suppressor beads. Recommended replacement clamps include a suppressor bead.

CHANGE L

Table 5-1:

Delete 8411A-A7R19 listing.

Table 5-2:

Add 8411A-A7R3; FUNCTION AFFECTED, VTO lower frequency limit; NORMAL RANGE OF VALUES, 10-196Ω; COMPONENT LOCATION FIGURE 8-32; ADJUSTMENT PROCEDURE, Paragraph 5-19.

Paragraph 5-19:

Change step h to read: Set power supply and sweep stability control for 9.4 Vdc ± .02 Vdc. Adjust 8411A-A7R5 (65 MHz ADJUST) for a VTO frequency of 65.0 MHz ±0.2 MHz. (If 65.0 MHz ±0.2 MHz cannot be obtained, remove 8411A-A7R3 to disable the low-frequency clamping action of A7CR4).

Add the following step after step h and reletter the remining steps: Adjust SWEEP STABILITY control for lowest VTO frequency. The VTO frequency should be 62 MHz ± 1 MHz. If not, select the value of 8411A-A7R3 as follows:

1. Remove A7R3.
2. Adjust SWEEP STABILITY control for VTO frequency below 60 MHz.
3. Select a value of A7R3 that shifts the VTO frequency to 62 MHz ± 1 MHz. (Typical range of values for A7R3 is 10 to 196 Ohms.)

Table 6-4:

Change A7 to HP Part Number 08411-6002.

Delete A7C14, A7C15, and A7C16 listings.

CHANGE L (Cont'd)

Add A7CR4, HP Part Number 1902-0041 DIODE: BREAKDOWN 5.11V 5% 400 MW.

Delete A7CR5, A7CR6, and A7Q5 listings.

Change A7R2 to HP Part Number 0757-0317 R: FXD MET FLM 1.33 K OHM 1% 1/8W.

Change A7R3 to HP Part Number 0757-0401 R: FXD MET FLM 100 OHM 1% 1/8W.

Delete A7R19, A7R20, and A7R21 listings.

Figure 8-32:
Replace Figure 8-32 Lower Half, A7 Parts Location illustration with Figure 7-4 in this Section.

Figure 8-33:
Replace P/O Figure 8-33, A7 Schematic Diagram in the manual with Figure 7-5 in this Section.

CHANGE M

Table 6-4:
In listing for Figure 6-5, change Item 20 to HP Part No. 2200-0057 SCREW: SST FH POS DR 4-40 x 5/16.

CHANGE N

Table 5-1:
Delete 8411A-A5R20 listing.

Delete 8411A-A5R21 listing.

Table 5-2:
Add 8411A-A5L1; FUNCTION AFFECTED, Channel phase balance; NORMAL RANGE OF VALUES 3.3 — 4.7 μH; COMPONENT LOCATION FIGURE 8-29; ADJUSTMENT PROCEDURE, paragraph 5-20.

Add 8411A-A5R8; FUNCTION AFFECTED, Test channel preamplifier gain; NORMAL RANGE OF VALUES, 343-909Ω; COMPONENT LOCATION FIGURE 8-29; ADJUSTMENT PROCEDURE, paragraph 5-20.

Add 8411A-A5R19; FUNCTION AFFECTED, Channel phase balance; NORMAL RANGE OF VALUES, 21.5-196Ω; COMPONENT LOCATION FIGURE 8-29; ADJUSTMENT PROCEDURE, pagragraph 5-20.

Table 6-4:
Change A3R4 and A3R7 to HP Part Number 0698-3396, R: FXD MET FLM 38.3 OHM 1% 1/2 W.

Change A3R5, A3R6, A3R8 and A3R9 to HP Part Number 0698-3392, R: FXD MET FLM 23.7 OHM 1% 1/2 W.

Change A5R8 to HP Part Number 0757-0416 R: FXD MET FLM 511 OHM 1% 1/8 W.

Change A5R19 to HP Part Number 0698-3438 R: FXD MET FLM 147 OHM 1% 1/8 W FACTORY SELECTED PART.

Delete A5R20 and A5R21 listings.

Figure 8-27:
Change A3R5, A3R6, A3R8 and A3R9 to 23.7 ohms.

CHANGE N (Cont'd)

Change A3R4 and A3R7 to 38.3 ohms.

Figure 8-28:
Change upper right box to read: Change the value of A5R8 to 343 ohms (maximum gain). If pre-amplifier gain is still low, check gain through each stage to isolate trouble.

Figure 8-29:
Replace P/O Figure 8-29, A5 Parts Location in the manual with the Figure 7-6 in this Section.

Figure 8-30:
Change A5C13 to 9-35 pF.

Change A5R8 to 511 ohms (typical value).

Change A5R19 to 147 ohms and add asterisk (*).

Delete R20 and R21; replace with shorts.

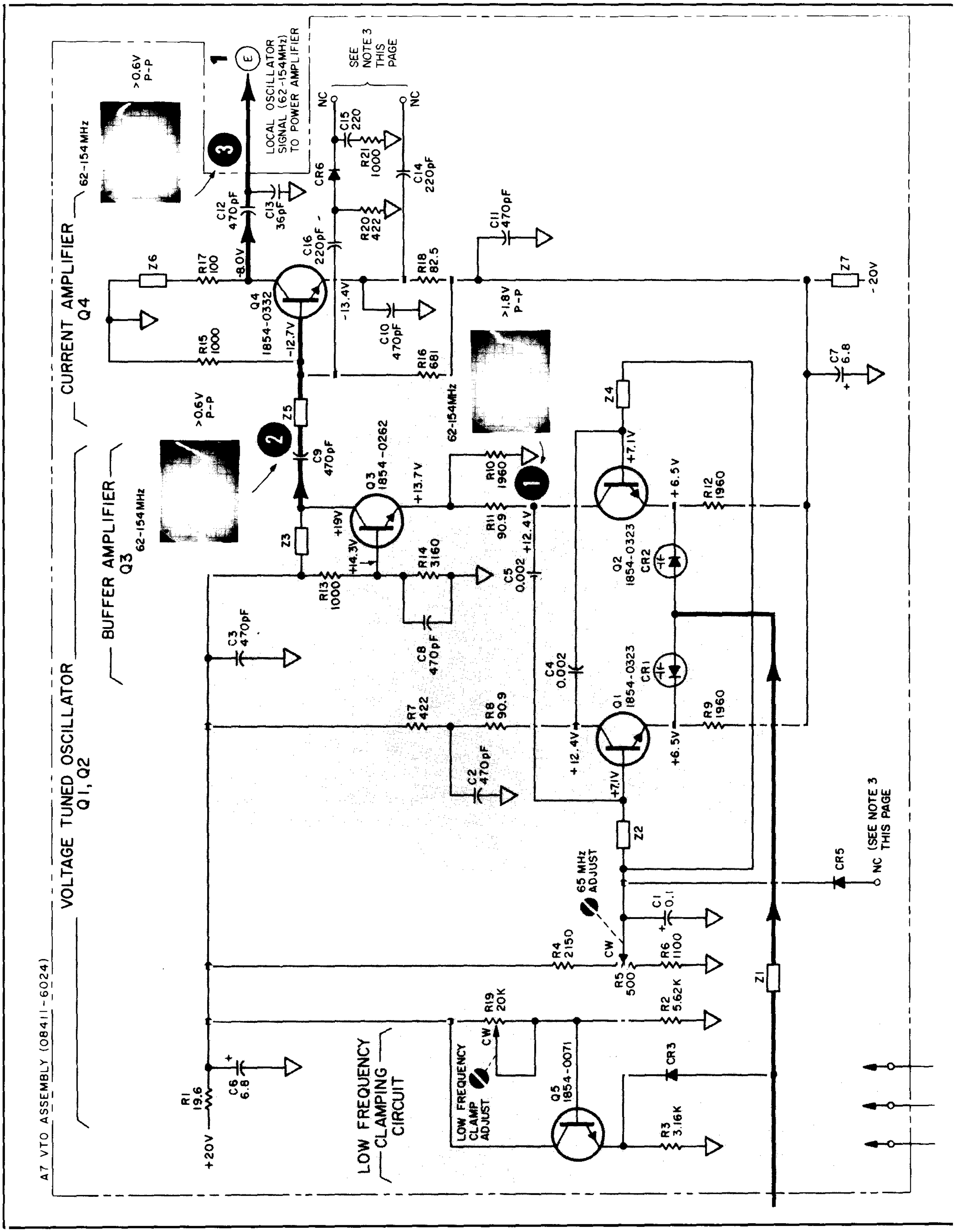
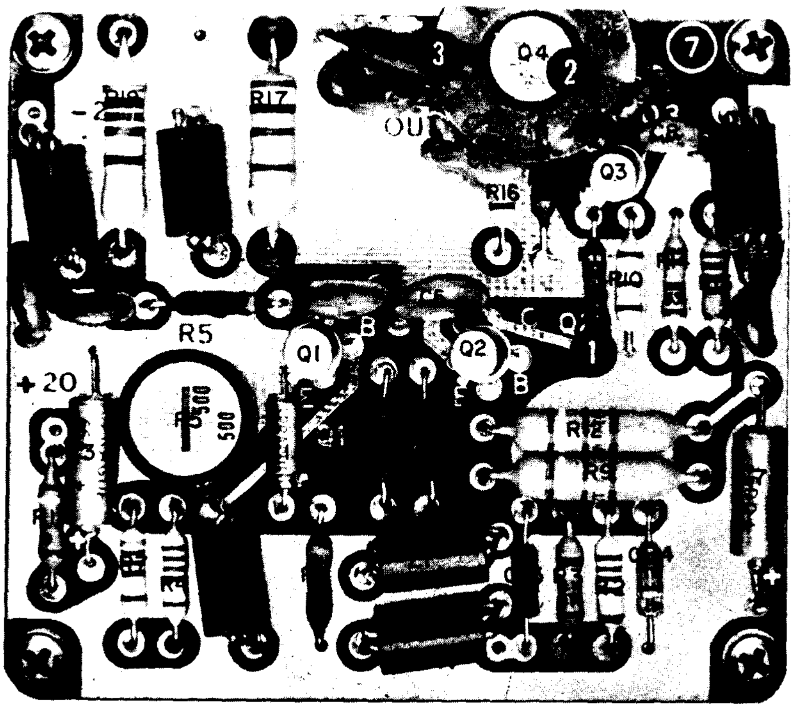


Figure 7-3. (P/O Figure 8-33.) 8411A-A7 Schematic Diagram (Change J)



A7

Figure 7-4. (P/O Figure 8-32.) 8411A-A7 Parts Location (Change L)

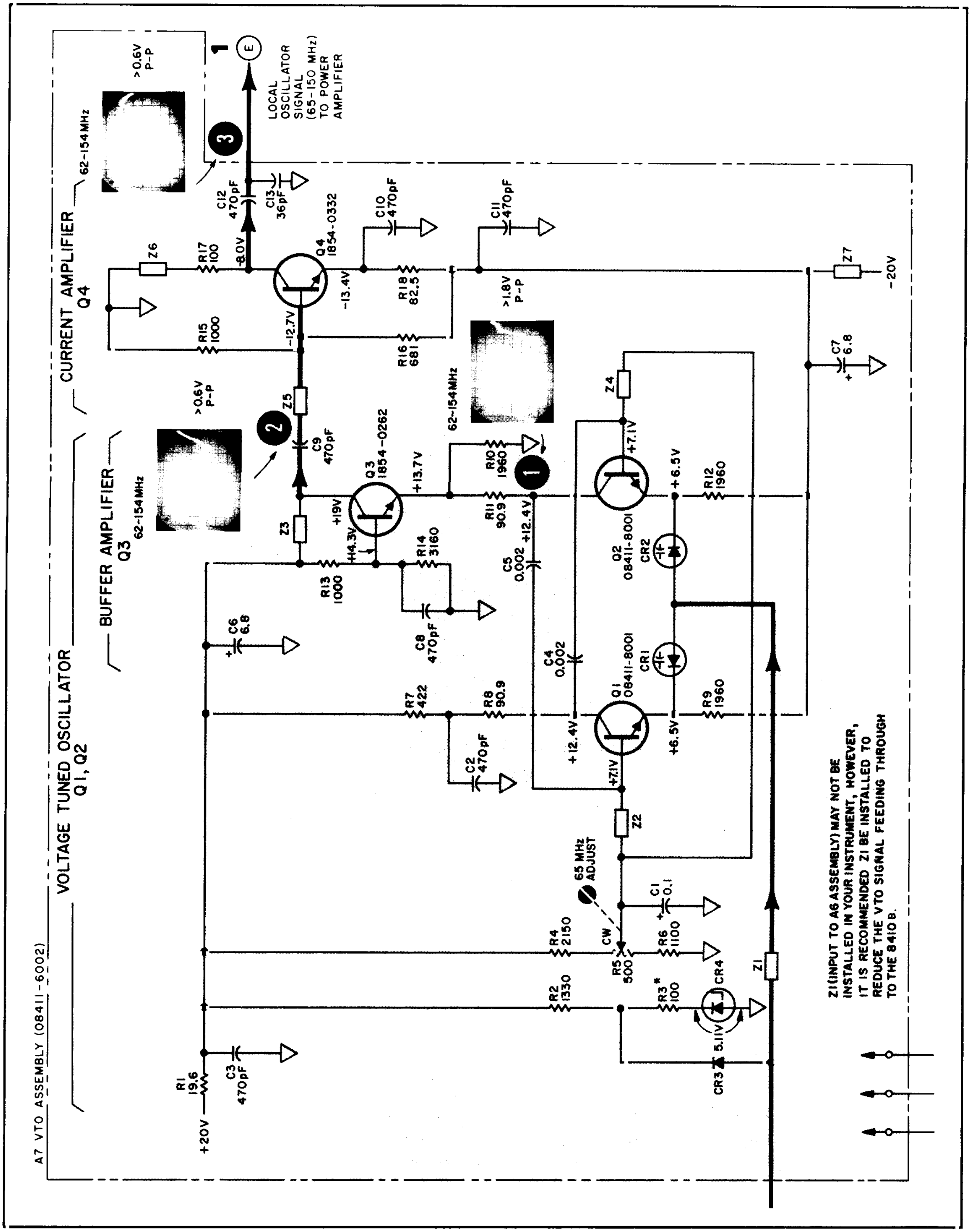


Figure 7-5. (P/O Figure 8-33.) 8411A-A7 Schematic Diagram (Change L)

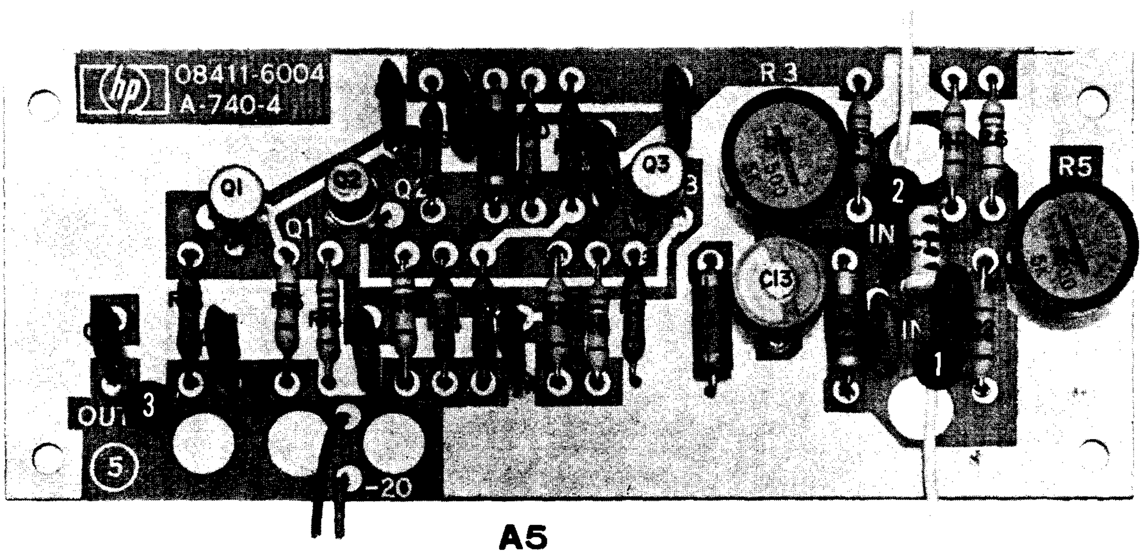


Figure 7-6. (P/O Figure 8-29.) 8411A-A5 Parts Location (Change N)

SECTION VIII
SERVICE

8-1. INTRODUCTION

8-2. This section provides instructions for troubleshooting, and repair of the 8410B Network Analyzer and 8411A Harmonic Frequency Converter. A cross reference of a assembly to service sheet number is located on table 8-1.

8-3. MAINTENANCE PRECAUTIONS

WARNING

Any service or adjustment performed with the covers removed should only be performed by qualified service personnel. A shock hazard exists with the covers removed.

STATIC DISCHARGE. The sampling diodes in the 8411A may be damaged by a discharge of static electricity. Momentarily ground and short connections of external equipment prior to making connection to 8411A input connectors.

MAXIMUM INPUT LEVELS. Maximum input at 8411A before damage occurs is 50 mW RF and 3 Volts DC. RF levels above −10 dBm in the test channel and −16 dBm in the reference channel will cause distortion in the 8411A preamplifiers.

SOLDERING ON PRINTED CIRCUITBOARDS. The soldering tool should have a power rating no higher than 40 watts and a tip no wider than 1/8 inch. If these limits are exceeded, the board may be damaged by burning, by lifting the printed circuit, or by spotting.

GROUNDING TRANSISTORS. Do not short-circuit the case of a chassis mounted transistor to the chassis because some transistors have collector internally connected to the case.

MAGNETIC FIELDS. When using 8414A Polar Display plug-in, do not place the 8410B near a sweep generator containing a BWO which has an unshielded permanent magnet or the CRT may be permanently magnetized, causing poor focus. Separate 8414A from any magnetic source by at least two feet.

8-4. LINE VOLTAGE REQUIREMENTS

8-5. During testing, the network analyzer must be connected to a source of power which is 50 to 60 Hz and 100, 120, 220, or 240 Vac +5% −10%. If adjustment of the dc power supplies is necessary, the network analyzer should be connected through a variable auto transformer to the ac power source. The line voltage at the input of the 8410B may then be adjusted ±10% of nominal (100, 120, 220, or 240 Vac) to check regulator action in the power supply.

8-6. MAINTENANCE AIDS

8-7. Servicing Aids On Printed Circuit Boards

8-8. As shown in Figure 8-1, the servicing aids provided on circuit boards include pry holes, numbered test points, transistor designators, terminal numbers, assembly designators, and assembly stock numbers with number-coded revision information.

8-9. Circuit Board Extender

8-10. A circuit board extender (HP Part No. 08410-60109) is supplied with the 8410B and is stored behind the front panel assembly (Figure 8-15). The extender raises boards clear of the chassis for easier access to the test points, and is designed to work with either 12 or 15 pin circuit boards.

8-11. Printed Circuit Board Removal

CAUTION

Turn off the line voltage before removing, or replacing printed circuit boards. Damage to integrated circuits may occur if power is applied during printed circuit board removal or replacement.

Table 8-1. Service Sheets

SERVICE SHEET & SCHEMATIC	ASSEMBLY NAME	ASSEMBLY NO.	HP PART NO.	PARTS LOCATION FIGURE NO.
1 8-27	Sampler Sampler Power Amplifier Stripline Assembly Shaping Amplifier	8411A-A1 8411A-A2 8411A-A3 8411A Stripline 8411A-A6	08411-80010 08411-80011 08411-6005 08411-60029 08411-6001	8-9 8-9 8-26 8-9 8-32
2 8-30	Reference Preamplifier Test Preamplifier	8411A-A4 8411A-A5	08411-6003 08411-6004	8-29 8-29
3 8-33	Shaping Amplifier VTO (Voltage-Tuned Oscillator)	8411A-A6 8411A-A7	08411-6001 08411-6024	8-32 8-32
4 8-36	Test AGC Amplifier Reference AGC Amplifier	8410B-A12 8410B-A14	08410-6038 08410-6039	8-35 8-35
5 8-39	Reference 278 kHz Amplifier	8410B-A16	08410-60062	8-38
6 8-42	20 MHz Oscillator	8410B-A13	08410-6008	8-41
7 8-45	AGC Amplifier	8410B-A15	08410-6040	8-44
8 8-48	0–9 dB Attenuator 0–60 dB Attenuator Amplitude Attenuator Amplifier	8410B-A2 8410B-A3 8410B-A11	08410-6014 08410-6015 08410-60073	8-20 8-20 8-47
9 8-51	20.278 MHz IF Amplifier	8410B-A4	08410-6003	8-50
10 8-54	Phase Detector 20.278 MHz Oscillator	8410B-A5 8410B-A6	08410-6037 08410-6009	8-53 8-53
11 8-57	VTO DC Amplifier Search	8410B-A7 8410B-A8	08410-6041 08410-6007	8-56 8-56
12 8-60	Interconnect Power Supply (+20V & -20V)	8410B-A10 8410B-A10A1	08410-6049 08410-6050	8-59 8-59
13 8-62	Interconnect Power Supply (-11 Vdc & 175 Vac) Power Line Module	8410B-A10 8410B-A10A1 8410B-FL1	08410-6049 08410-6050 0960-0444	8-59 8-59 8-15
14 8-64	Automatic Control	8410B-A9	08410-60106	8-63
15 8-66	A/D Converter	8410B-A18	08410-60107	8-65
16 8-68	Frequency Range	8410B-A19	08410-60108	8-67
17 8-69	Signal Wiring Diagram	8410B-A1S1	08410-6013	None

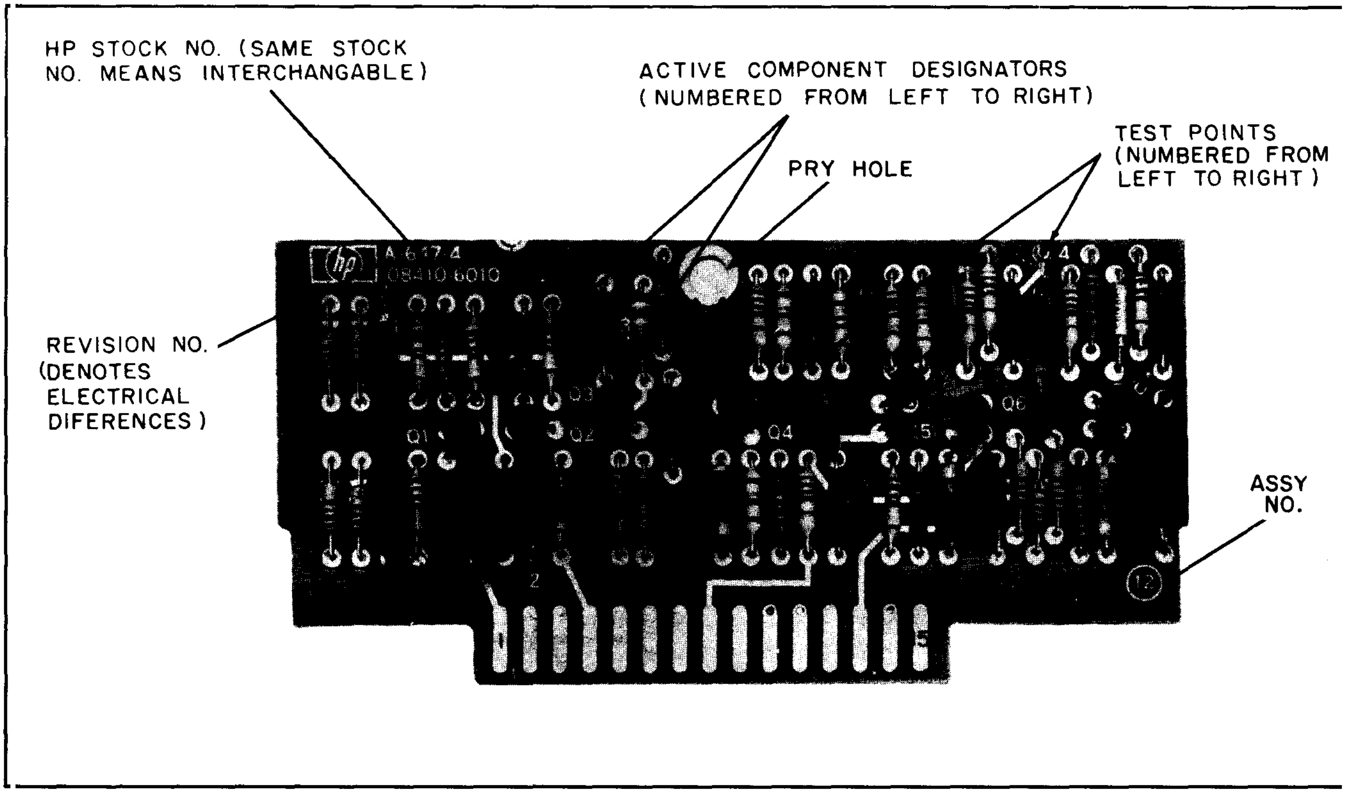


Figure 8-1. Servicing Aids on Circuit Boards

8-12. When removing printed circuit assemblies from the 8410B, care must be taken not to damage the assemblies. A pry hole (Figure 8-1) is located in the top center of each board. To remove the board, insert a soldering aid or screwdriver into the hole and pry against the housing. To prevent bowing the circuit board, apply pressure to the side of the board with the index finger to counteract the sideways pressure of the soldering aid or screwdriver (see Figure 8-2).

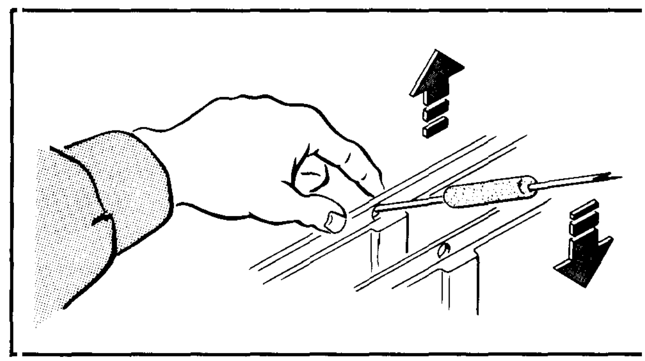


Figure 8-2. Printed Circuit Board Removal

8-13. Test Points

8-14. The 8410B printed circuit assemblies contain test point posts with the test point number designation etched on the board (Figure 8-1). The schematic diagram for each assembly has the corresponding test point shown as a numbered black spot.

8-15. The 8411A printed circuit assemblies do not have test point posts. Test points shown on the schematic diagrams and the corresponding parts location diagram were selected as convenient locations to monitor voltage waveforms and do not indicate test-point post locations.

8-16. TROUBLESHOOTING

8-17. General Procedure

8-18. The troubleshooting procedure is divided into three maintanance levels. The first level of troubleshooting isolates trouble to either the 8410B or 8411A. (See Figure 8-19.) The next level of troubleshooting further isolates trouble to a single printed circuit board, where possible. (See Figure 8-21 and 8-22). The last level of troubleshooting isolates trouble to a circuit within the printed circuit board. Procedures for this level are located on the page facing the schematic

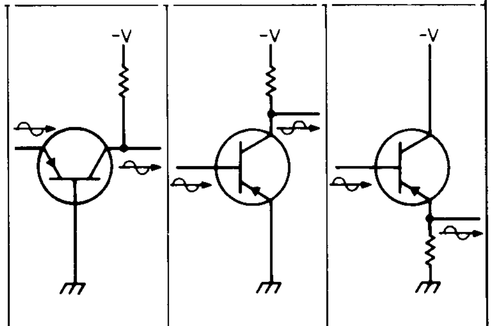
diagram of each printed circuit board. Normal test point waveforms and voltages used in these procedures are shown on the schematic diagrams and are obtained, using the standard test conditions described in Figure 8-12. Test equipment required for troubleshooting is listed in Table 1-8.

8-19. After a trouble has been located and corrected, either by performing an adjustment procedure or by replacing an assembly or component, the performance test procedures in Section IV should be performed. This ensures that all circuits in the instrument are operating within specifications.

8-20. Transistor In-Circuit Testing

8-21. The common causes of transistor failures are internal short-and open-circuits. In transistor circuit testing, the most important consideration is the transistor base-to-emitter junction. Like the control grid of a vacuum tube, this is the operational control point in the transistor. This junction is essentially a solid-state diode. For the transistor to conduct, the diode must conduct; that is, the diode must be forward biased. As with simple diodes, the forward-bias polarity is determined by the materials forming the junction. Use the transistor symbol on the schematic diagram to determine the bias polarity required to forward-bias the base-emitter junction. The B part of Figure 8-3 shows transistor symbols with terminals labeled. Notice that the emitter arrow points toward the type N material. The other two columns of the illustration compare the biasing required to cause conduction and cut-off in NPN and PNP transistors. If the transistor base-emitter diode (junction) is forward-biased, the transistor saturates. However, if the base-emitter diode is reverse-biased the transistor is cut off (open). The voltage drop across a forward-biased, emitter-base diode varies with transistor collector current. For example, a germanium transistor has a typical forward-bias, base-emitter voltage of 0.2 to 0.3 volt when collector current is 1 to 10 mA, and 0.4 to 0.5 volt when collector current is 10 to 100 mA. In contrast, forward-bias voltage for silicon transitors is about twice that for germanium types; about 0.5 to 0.6 volt when collector current is low, and about 0.8 to 0.9 volt when collector current is high.

A. Amplifier Characteristics



CHARACTERISTIC	COMMON BASE	COMMON EMITTER	COMMON COLLECTOR
Input Impedance	30Ω-50Ω	500Ω-1500Ω	20KΩ-500KΩ
Output Impedance	300KΩ-500KΩ	30KΩ-50KΩ	50Ω-1000Ω
Voltage Gain	500-1500	300-1000	<1
Current Gain	<1	25-50	25-50
Power Gain	20dB-30dB	25dB-40dB	10dB-20dB (Emitter Follower)

B. Transistor Biasing

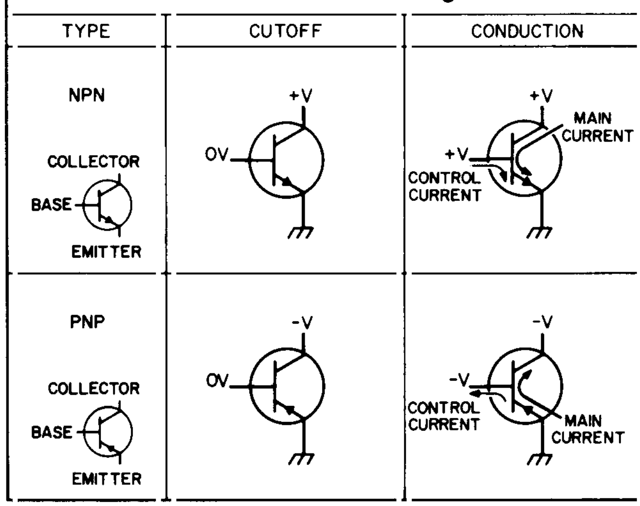


Figure 8-3. Transistor Operation

8-22. Figure 8-3, part A, shows simplified versions of the three basic transistor circuits and gives the characteristics of each. When examining a transistor stage, first determine if the emitter-base diode is biased for conduction (forward-biased) by measuring the voltage difference betweeen emitter and base. When using an electronic voltmeter, do not measure directly between emitter and base; there may be sufficient loop current between the voltmeter leads to damage the transistor. Instead, measure each voltage separately with respect to a voltage

common point (e.g., chassis). If the emitter-base diode is forward-biased, check for amplifier action by short-circuiting base to emitter while observing collector voltage. The short circuit eliminates base-emitter bias and should cause the transistor to stop conducting (cut off). Collector voltage should then shift to near the supply voltage. Any difference is due to leakage current through the transistor and, in general, the smaller this current, the better the transistor. If collector voltage does not change, the transistor has either an emitter-collector short circuit or emitter-base open circuit.

8-23. Transistor Out-of-Circuit Testing

8-24. The two common causes of transistor failure are internal short and open circuits. Remove the transistor from the circuit and use an ohmmeter to measure internal resistance. See Table 8-2 for measurement data.

Table 8-2. Out of Circuit Transistor Testing

Transistor Type		Connect Ohmmeter Pos. lead to	Connect Ohmmeter Neg. lead to	Measure Resistance (ohms)
PNP Germanium	Small Signal	emitter	base*	200-250
		emitter	collector	10K-100K
	Power	emitter	base*	30-50
		emitter	collector	several hundred
PNP Silicon	Small Signal	emitter	base*	10K-100K
		emitter	collector	very high (might read open)
NPN Silicon	Small Signal	base	emitter	1K-3K
		collector	emitter	very high (might read open)
	Power	base	emitter	200-1000
		collector	emitter	high, often greater than 1M

*To test for transistor action, add collector-base short. Measured resistance should decrease.

CAUTION

Most ohmmeters can supply enough current or voltage to damage a transistor. Before using an ohmmeter to measure transistor forward or reverse resistance, check its open-circuit voltage and short-circuit current output ON THE RANGE TO BE USED. Open-circuit voltage must not exceed 1.5 volts and short-circuit current must be less than 3 mA. See Table 8-3 for safe resistance ranges for some common ohmmeters.

Table 8-3. Ohmmeters Used for Transistor Testing

Ohmmeter	Range(s)	Open Circuit Voltage	Short Circuit Current	Lead Color	Lead Polarity
HP 412A HP 427A	R x 1K R x 10K R x 100K R x 1M R x 10M	1.0V 1.0V 1.0V 1.0V 1.0V	1mA 100μA 10μA 1μA 0.1μA	Red Black	+ -
HP 410C	R x 1K R x 10K R x 100K R x 1M R x 10M	1.3V 1.3V 1.3V 1.3V 1.3V	0.57mA 57μA 5.7μA 0.5μA 0.05μA	Red Black	+ -
Simpson 260	R x 100	1.5V	1mA	Red Black	+ -
Simpson 269	R x 1K	1.5V	0.82mA	Black Red	+ -
Triplett 310	R x 10 R x 100	1.5V 1.5V	750μA 75μA	Varies with Serial Number	

8-25. Standard Circuits

8-26. Diode Limiter or Clipper. The limiter or clipper is a circuit which removes positive or negative peaks from a waveform. It can be used either as a waveform shaping circuit or as a protective device to prevent excessive voltages.

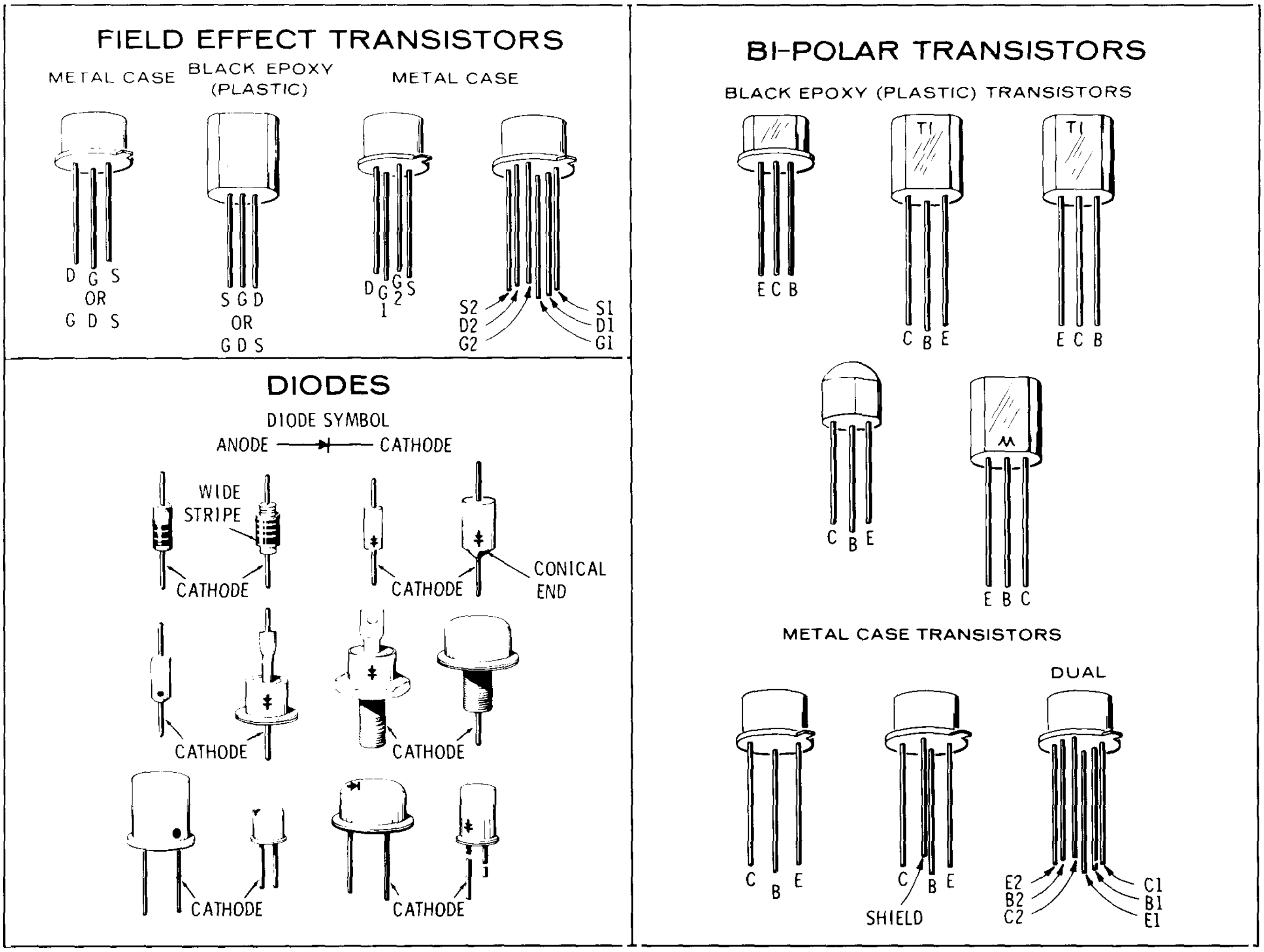


Figure 8-4. Examples of Diode and Transistor Marking Methods

Figure 8-5, Schematic A, shows a limiter which prevents the negative peak of the pulse from exceeding about −0.6 volt. Note that for a conducting silicon diode the cathode voltage is about 0.6 to 0.8 volt more negative than the anode. A typical diode limiter circuit is 8410B—A15CR2.

8-27. Diode Clamp. The clamper is a circuit which establishes either the positive or negative peak of a waveform at a particular dc reference voltage; in other words, it provides a definite baseline voltage for the waveform. Figure 8-5, Schematic B, shows a clamper which provides a baseline of about +20 volts for a negative pulse. A typical diode clamper circuits is 8410B—A7CR1.

8-28. Diode Regulator. A diode regulator uses either the constant reverse-bias breakdown voltage characteristic of a breakdown diode or the constant forward-bias voltage drop characteristic of a silicon diode. Power supply reference voltages are generally provided by breakdown diodes which maintain a constant voltage when supplied with a reverse-bias voltage greater than their specified breakdown voltage. Regulated voltages can also be

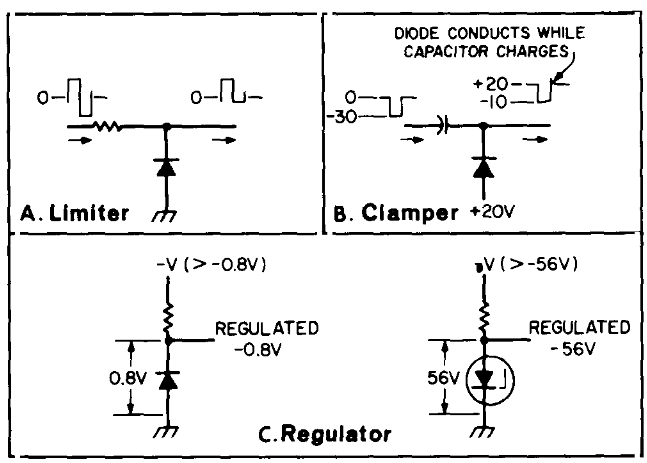


Figure 8-5. Basic Diode Circuits

provided by a forward-biased silicon diode which maintains a constant 0.6- to 0.8-volt drop. Figures 8-5, Shematic C, shows connections for both types of diodes. A typical circuit of this type is 8410B—A10VR3.

8-29. Transistor Amplifiers. There are three basic amplifier configurations (Figure 8-3, Part A). These amplifiers may be used alone or in combination to form complex circuits.

8-30. Transistor Biasing and Conduction. In a transistor a small base-to-emitter current controls a large collector-to-emitter current. Typical NPN transistor and PNP transistor operation is shown in Figure 8-3, Part B; indicated current represents conventional flow of positive charges external to the transistor and is not intended to indicate flow of carriers inside the transistor structure. Notice that the effect of emitter-base-collector voltages is totally reversed between NPN and PNP transistors; circuits which are arranged for an NPN transistor usually function normally for a PNP transistor if supply voltages are reversed.

8-31. Trigger Circuit. The trigger circuit (Figure 8-6, Schematic A) is a limiter or squaring circuit which produces an output waveform with very fast rise and fall times. The trigger circuit is similar to the flip-flop except that the RC network in one half is replaced by the input signal. Capacitor C1 bypasses R3 to couple fast changes in voltage at the Q1 collector to the base of Q2. Either Q1 or Q2 can conduct depending on the voltage at the input. Note that there is a slight difference in input voltage (called hysteresis) between switching with a negative-going input (time t_2). A typical circuit of this type is 8410B—A8Q1 and Q2.

8-32. Differential Amplifier. The differential amplifier (Figure 8-6, Schematic B) is composed of two transistor stages coupled together in the emitter circuit. Signals at the output of the two collectors are 180 degrees out of phase. Inverse feedback may be applied to the base of Q2 as shown. As voltage at the emitter of Q1 changes, the emitter of Q2 also changes by the same amount. This changes the base-to-emitter bias of Q2. If a more negative voltage were applied to the base of Q1, current through Q1 would decrease, causing the emitter of Q1 to go in the negative direction. A negative-going voltage at the emitter of Q2 increases the effective forward bias

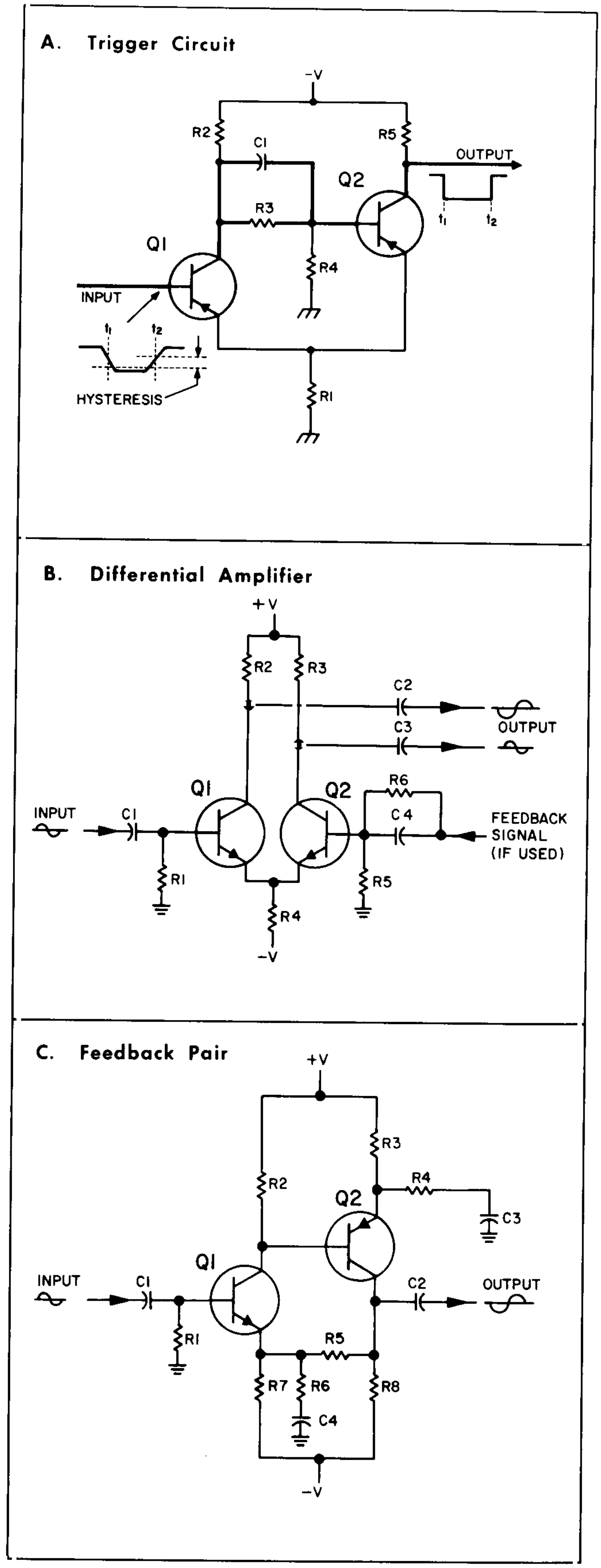


Figure 8-6. Basic Transistor Circuits

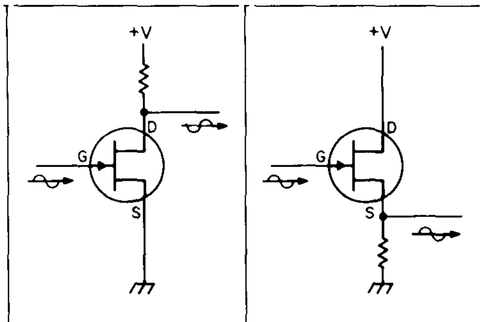
between base and emitter of Q2, causing it to conduct more heavily. Therefore, when current through Q1 decreases, current through Q2 increases. A typical circuit of this type is 8410B—A14Q1 and Q2.

8-33. Feedback-Pair Amplifier. The feedback-pair amplifier (Figure 8-6, Schematic C) is a high-gain direct-coupled amplifier stage composed of an NPN and a PNP transistor cascaded together. Feedback of the pair is accomplished by an RC network between the collector of Q2 and the emitter of Q1. Voltage gain of the stage may be calculated by the formula: R5 plus R6 divided by R6. Gain through the amplifier may be changed by selecting either R5 or R6. A typical circuit of this type is 8410B—A4Q5 and Q6.

8-34. Field Effect Transistor (FET). Field effect transistors (Figure 8-7) have three terminals: source, drain, and gate which correspond in function to emitter, collector, and base of junction transistors. Source and drain leads are attached to the same block (channel) of N or P semiconductor material. A band of oppositely doped material around the channel (between the source and drain) is connected to the gate lead.

8-35. In normal FET operation, the gate-source voltage reverse-biases the PN junction, causing an electric field that creates a depletion region in the source-drain channel. In the depletion region the number of available current carriers is reduced as the reverse-biasing voltage increases, making source-drain current a function of gate-source voltage. With the input (gate-source) circuit reverse-biased, the FET presents a high impedance to its signal sources (as compared with the low impedance of the forward-biased junction transistor base-emitter circuit). Because there is no input current, FET's have less noise than junction transistors. Figure 8-7 shows the schematic symbol and biasing for N channel and P channel field effect transistors.

A. FET Amplifier Characteristics



CHARACTERISTIC	COMMON SOURCE	COMMON DRAIN (Source Follower)
Input Impedance	1MΩ-15MΩ	1MΩ-15MΩ
Output Impedance	50KΩ-100KΩ	1KΩ-10KΩ
Voltage Gain	10-200	<1
Power Gain	60dB-100dB	40dB-80dB

B. FET Biasing

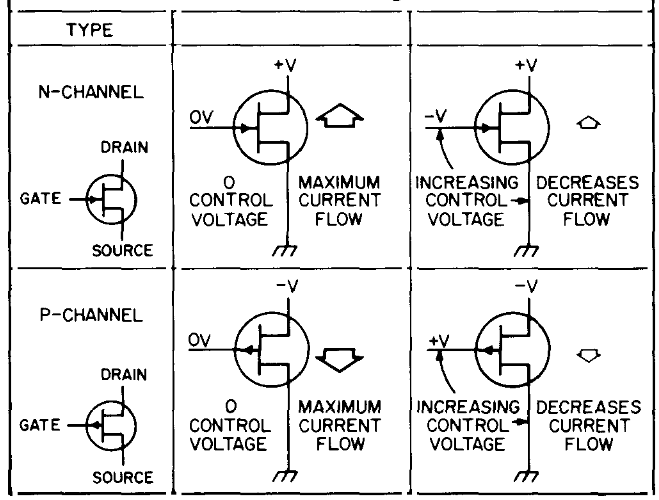


Figure 8-7. Field Effect Transistor Operation

8-36. RECOMMENDED TEST EQUIPMENT

8-37. Test equipment required to maintain the Model 8410B/8411A is listed in Section I. If the equipment listed is not available, equipment that meets the minimum specifications shown may be substituted. (Figure 8-12. Standard Test Setup for Waveforms supplied.)

8-38. REPAIR

8-39. Part Location Aids

8-40. The locations of chassis-mounted parts and major assemblies is shown in Figures 8-9 and 8-20. The locations of individual components mounted on a printed circuit board are shown opposite the appropriate schematic diagram. The part reference designator may be found from the schematic diagram.

8-41. Module Exchange Program

8-42. This instrument may be quickly repaired by replacing a defective module with a restored-exchange module. To support the modular repair concept Hewlett-Packard has set up a module exchange program.

8-43. The procedure for using the module exchange program is given in Figure 8-8. When you locate the defective module, order a replacement module through the nearest Hewlett-Packard sales office. The restored-exchange module will be sent immediately directly from a customer service replacement parts center. When you receive the exchange module, return the defective module in the same special carton in which the exchange module was received. DO NOT return a defective module to Hewlett-Packard until you receive the exchange module.

8-44. If you are not going to return the defective module to Hewlett-Packard, or if you are ordering a module for spare parts stock, etc., order a new module using the new module part number listed in Table 6-3 or 6-4.

8-45. The Hewlett-Packard module exchange program allows you to obtain a fully tested and guaranteed restored-exchange module at a reduced price. (The reduced price is contingent upon return of the defective module to Hewlett-Packard.) Assemblies available for module exchange are listed in Table 6-1.

8-46. After Service Product Safety Checks

8-47. Visually inspect interior of instrument for any signs of abnormal internally generated heat, such as discolored printed circuit boards or components, damaged insulation, or evidence of arcing. Determine and remedy cause of any such condition.

8-48. Using a suitable ohmmeter, check resistance from instrument enclosure to ground pin on power cord plug. The reading must be less than one ohm. Flex the power cord while making this measurement to determine whether intermittent discontinuities exist. Check resistance from instrument enclosure to line and neutral (tied together) with the line switch ON and the power source disconnected. The minimum acceptable resistance is 2 megohms. Replace any component which results in failure to meet this minimum.

8-49. Check line fuse to verify that a correctly rated fuse is installed.

8-50. Special Installation Instructions

8-51. Replacement of certain components in the 8410B and 8411A requires special procedures to prevent damage to parts and to complete proper installation. Components which require special procedures are the following:

a. Cable 8411A-W1.
b. Samplers 8411A-A1 and A2.
c. Power Amplifier 8411A-A3.
d. 8411A Stripline.
e. Step Generator Diode 8411A-CR1.
f. Connector 8410B-J1.

8-52. 8411A Cable W1, HP Part No. 08411-6013. HP Part No. 08411-6013 includes a kit which contains additional parts required to install the cable.

Parts Included in the Cable Replacement Kit

Qty	Description	HP Part No.
1	Cable Assembly	08411-6013
3	Coax Feed-thru	08411-2017
1	Service Note	P-08411-6013

To replace cable W1 perform the following:

a. Preparation of 8411A.

1. Cut off old wires and coaxial leads where they enter the 8411A casting (inside).

2. Remove boot and old cable.

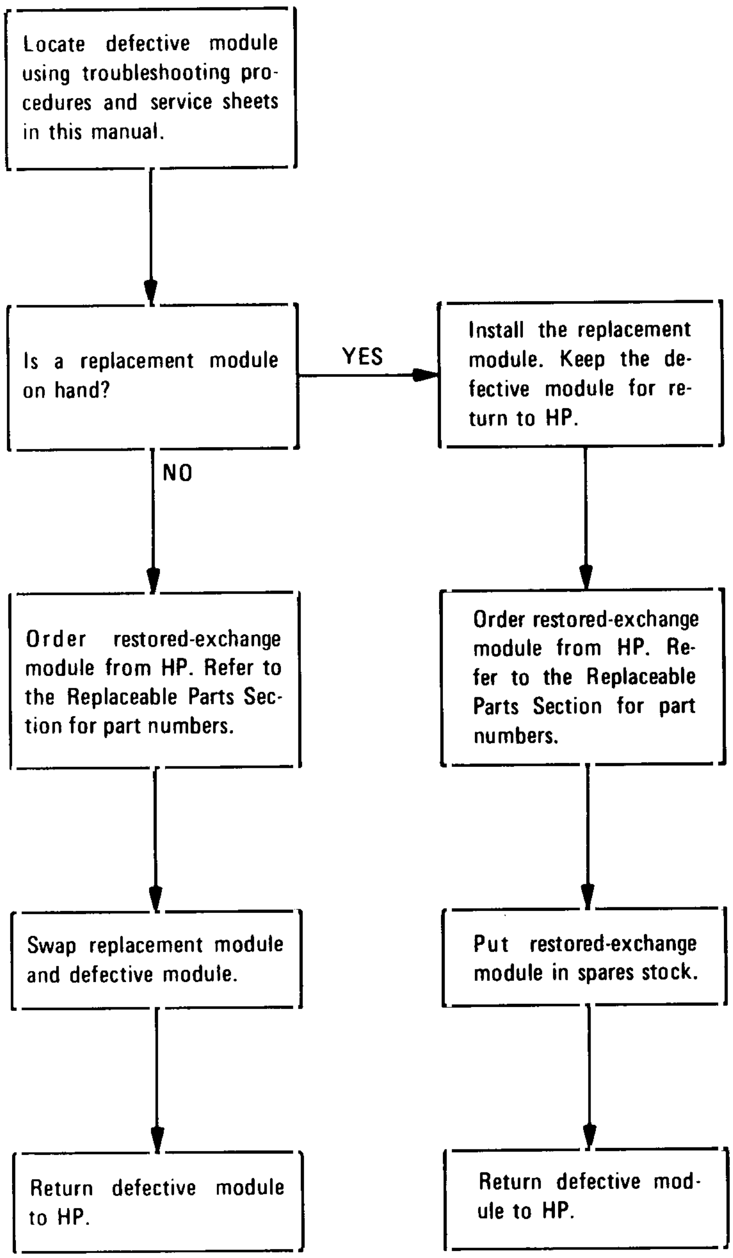
b. Installaion of Cable

NOTE

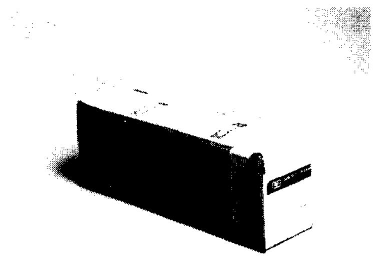
New cable has braid pulled over wires and coaxial leads. Braid is pointed to allow easy installation into 8411A.

1. Carefully insert cable (with clamp-washer and bolt installed on cable) into 8411A casting hole.

The module exchange program described here is a fast, efficient, economical method of keeping your Hewlett-Packard instrument in service.



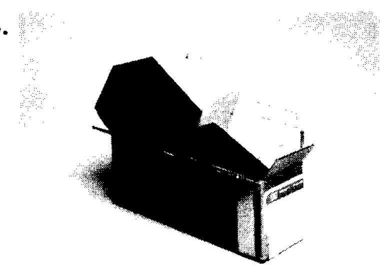
A.



Restored-exchange modules are shipped individually in boxes like this. In addition to the circuit module, the box contains:

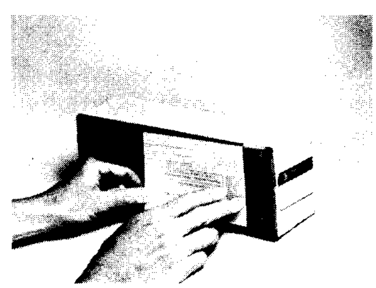
- Module repair report
- Return address label
- Tape for resealing box

B.



Open box carefully - it will be used to return defective module to HP. Complete repair report. Place it and defective module in box. Be sure to remove enclosed return address label.

C.



Seal box with tape provided. Inside U.S.A.*, stick preprinted return address label over label already on box, and return box to HP. Outside U.S.A., do not use address label: instead, address box to the nearest HP office.

*HP pays postage on boxes mailed in U.S.A.

Figure 8-8. Module Exchange Procedure

2. When three to four inches of braided cable are inside casting, cut braid away from cable at a point about 1/4 inch from clamp-washer.

NOTE

Clamp-washer must be firmly against cable jacket.

3. Flare braid over clamp-washer and trim at largest diameter shoulder of clamp-washer.

4. Carefully insert cable with clampwasher as far as possible into casting.

5. Rotate cable until black wire is uppermost.

NOTE

Boot must be tightened enough to cut rubber washer.

6. Hold wires firmly in place while moving boot against casting and tighten in place.

7. One at a time remove the old unshielded color-coded wires in the 8411A and replace with same color-coded wires from new cable. Insert white wire with red strip thru hole in casting. This wire will be connected later.

8. Remove old white coaxial cable and install center conducor with ferrite beads and shield of new white coaxial line.

9. Loosen mounting screws of 8411A-A4 circuit board and disconnect center conductor of red hole.

10. Remove old red coaxial lead and old metal feed-thru from casting wall.

11. Insert new red coaxial lead through first casting hole.

NOTE

Before installing new metal feed-thru in second casting wall, red coaxial leadwire should be installed and shield should be soldered to get sufficient heat on solder joint. Center conductor dielectric is teflon and will not be damaged by soldering heat applied to metal feed-thru.

12. Put center conductor lead through metal feed-thru. Extend shield over the new metal feed-thru and solder shield to feed-thru.

13. Install metal feed-through in second casting wall and tighten in place with nut from original feed-thru.

14. Tighten mounting screws of 8411A-A4 circuit board and connect conductor of red coaxial lead.

15. Using above procedure, steps 8 thru 14, install blue coaxial lead in other casting wall and connect to 8411A-A5.

16. Turn 8411A over, remove A7 Assy mounting screws and carefully lift end of A7 Assy closest to cable end of 8411A to expose wires under the assembly.

NOTE

The brown coax cable and white wire with red stripe are used in automatic systems only. For standard systems they may be cut off where they enter the 8411A; however, the old cable must be removed to prevent ground loop problems. If the brown coax is to be connected the outer conductor (shield) between the circuit board and feed-thru will be re-installed on the new center conductor.

17. Unsolder brown coax center conductor and shield from A7 Assy and cut off exposed center conductor to prevent damage to shield when removing center conductor.

18. Remove feed-thru retaining nut, feed-thru and old center conductor from casting.

19. Put new center conductor lead thru metal feed-thru. Extend shield over new metal feed-thru and solder shield to feed-thru.

20. Insert center conductor and feed-thru in casting. Carefully insert center conductor thru old outer conductor, install outer conductor ground lug and feed- thru retaining nut on feed-thru and tighten nut.

21. Connect center conductor and outer conductor to A7 Assembly.

22. Replace old white wire with red stripe with wire from new cable.

23. Replace A7 Assembly mounting screws.

8-53.Sampler Asemblies 8411A-A1 and A2.

To replace sampler, perform the following:

a. HANDLING PRECAUTIONS.

1. When attaching leads to the diode posts exert as little pressure as possible. Excessive pressure will break the diode.

2. Do not allow the sampler to rest on the diode posts.

3. The sampler diodes are sensitive to transients. When connecting leads to diode posts, always (a) connect the ground lead first, (b) discharge any energy stored in the other lead by grounding it, and (c) make connection to diode post.

4. Diodes may be damaged if placed in presence of large electrostatic fields.

b. REMOVAL PROCEDURE.

1. Remove APC-7 connector (Figure 8-9, Items 18 and 19) using spanner wrench, HP Stock Number 5060-0237 (supplied in Accessory Kit 11587A and APC-7 Connector Tool Kit 11591A).

2. Remove the two Pozidrive screws (20) holding the cover (21) located behind the APC-7 connector. Remove the cover and the parts under the cover, noting the order of removal.

3. Remove clip-on leads from both sides of sampler (24) and push leads into hole in casting.

NOTE

When plastic stripline cover, Figure 8-8, Item 1, is removed, step recovery diode (12), rubber gasket, Mylar shim (13), and pellet resistor (14) are loose and should be removed to prevent loss.

4. Remove metal screws (3 and 4) from plastic stripline cover (1) and remove cover.

5. Remove mixer coax clamps (6), ferrite bead, and two metal screws (10) from end section of stripline board.

6. Unsolder one end of stripline jumper (5) and remove end section stripline board.

7. Remove the four Pozidrive screws (25) holding the sampler in place and lift sampler from casting.

c. SAMPLER DIODE REPLACEMENT

CAUTION

The top diode (CR2) must NEVER be removed. If this diode is removed and the bottom diode (CR1) is still in position, the springloaded action of the bottom diode (CR1) will permanently damage the sampler stripline. The top diode (CR2) is shimmed using the proper thickness of spacer(s) so the diode just makes contact with the sampler stripline. This can only be done properly by using a microscope. Also note that two diode clips are used for CR2. If CR2 is defective, the entire sampler should be replaced.

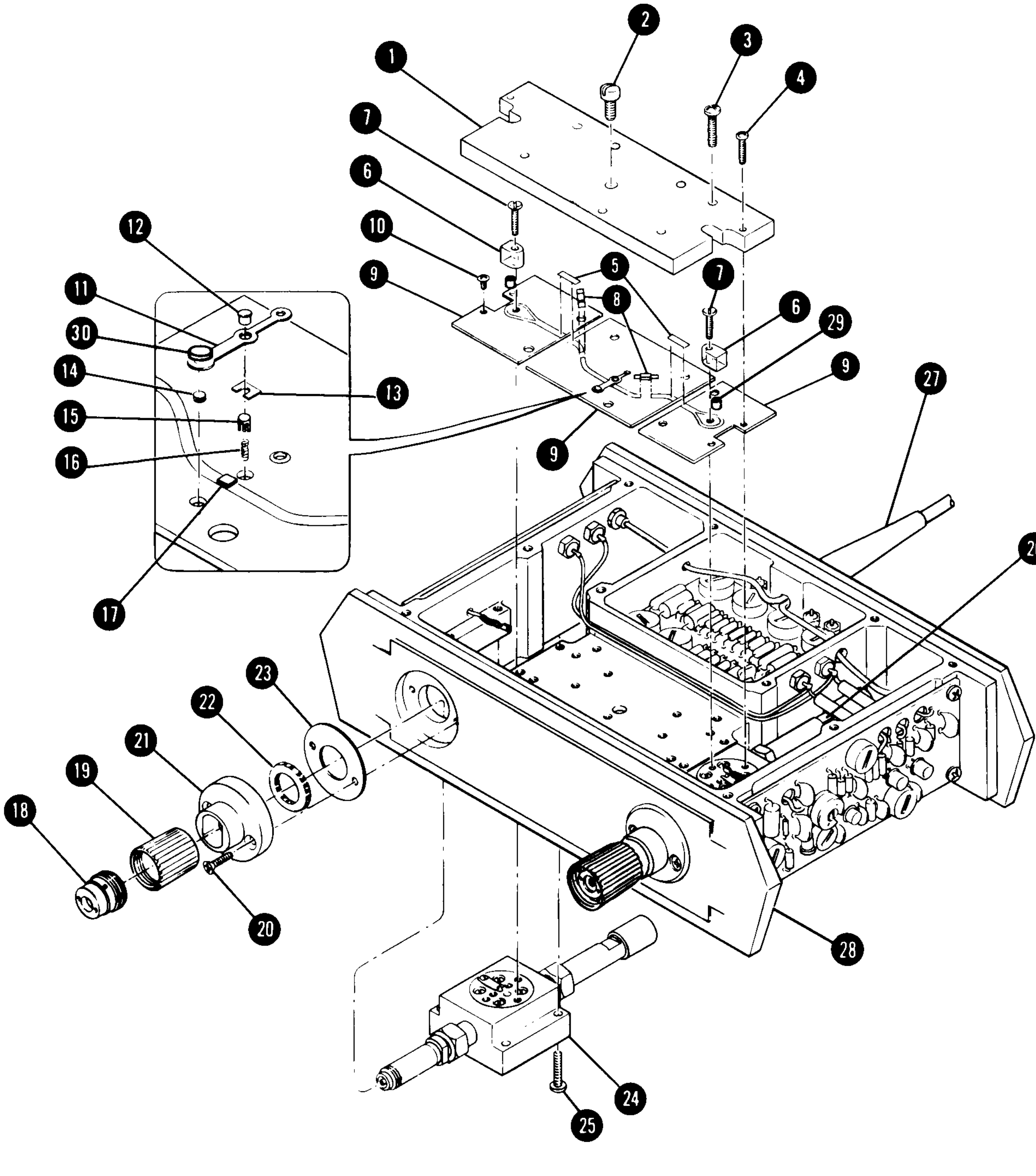


Figure 8-9. 8411A Exploded View

BOTTOM DIODE REPLACEMENT

1. Carefully loosen retaining screw (0520-0155) on bottom cap of sampler to loosen bottom diode clip (0510-0939). (See cutaway drawing.)

2. Remove screw, flat washer, diode clip, bottom diode (CR1), and spring washer from sampler housing.

3. Reinstall spring washer, new bottom diode, diode clip, flat washer, and retaining screw, then tighten screw.

d. INSTALLATION PROCEDURE

1. Insert new sampler into casting and install the four Pozidrive screws (25) to hold sampler in place. Do not tighten screws.

2. Install cover (21) and other parts removed in Removal Instructions, Step b-2, in reverse order of removal. Tighten the two Pozidrive screws (20) evenly.

3. Install the APC-7 connector (18 and 19).

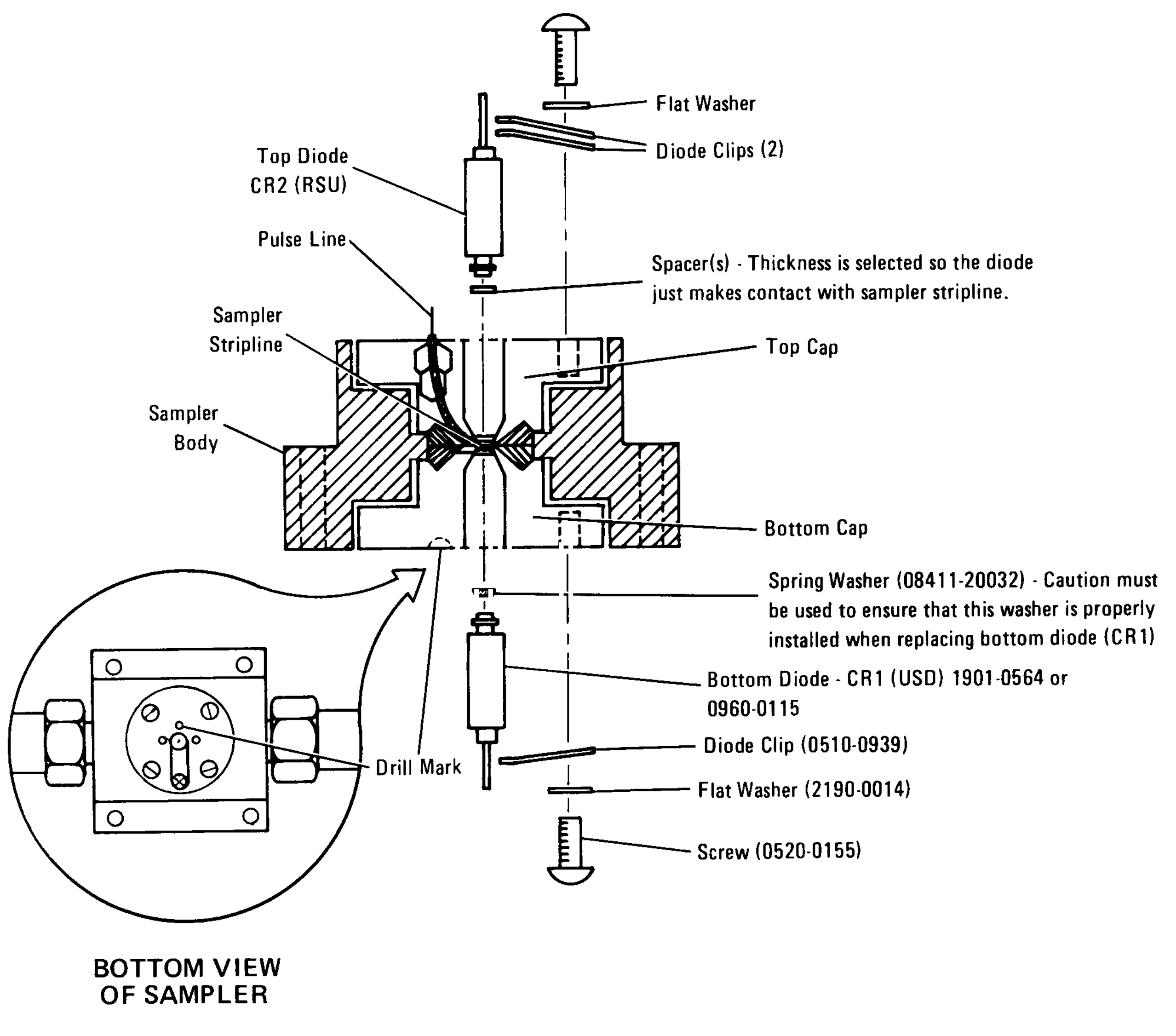


Figure 8-10. Sampler Diode Replacement

4. Align the sampler mechanically so that the distance from center to center of the two APC-7 connectors is 4.750 inches. Tighten the four screws (25) to secure the sampler. To check mechanical alignment of the sampler, connect the 8411A to an 8740A, 8741A, or 8742A.

CAUTION

Center conductor will break with excessive bending.

5. Insert 0.005-inch-diameter center conductor of sampler drive coax through hole in end section of stripline.

6. Install the two metal screws (10) holding the end section of stripline in place. Do not tighten screws.

NOTE

Use a microscope with vertical illuminator to center the hole over the outer conductor of the sampler drive coax.

7. Carefully center the 0.018-inch-diameter hole in the stripline over the outer conductor of the sampler drive coax and tighten the two metal screws (10) to secure the end section of the stripline.

8. Bend center conductor of drive coax to place it along center of stripline.

9. Carefully install plastic clamp (6), ferrite bead, and tighten screw (7).

10. Resolder stripline jumper (5) with as little solder as possible.

11. Install step-recovery diode (12), Mylar spacers (13), rubber gasket, and pellet resistor (14) if removed.

12. Install plastic stripline cover (1).

13. Ground each clip of clip-on leads to casting, then connect clip-on leads to each side of sampler.

14. Perform adjustment procedures, Paragraph 5-20 and 5-22, then the Performance Tests in Section IV.

8-54. Power Amplifier Assembly 8411A-A3.

To replace power amplifier, perform the following:

a. POWER AMPLIFIER REMOVAL.

1. Remove six Pozidrive screws from base of power amplifier.

2. Turn the 8411A upsidedown and remove plastic stripline cover (Figure 8-9, Item 1).

3. Remove step generator diode (12) and Mylar shim (13) under diode.

NOTE

Apply minimum amount of heat to avoid damage to stripline.

4. Unsolder connection on stripline from step generator to power amplifier.

5. Disconnect leads and remove power amplifier assembly from casting.

b. POWER AMPLIFIER INSTALLATION.

1. Clean solder from hole in stripline board (Figures 8-9, Item 9).

2. Place the power amplifier assembly in the casting.

3. Install and tighten the six Pozidrive screws in the base of the power amplifier.

4. Solder the power amplifier connection to the stripline board. (Do not add protective coating.)

5. Reinstall step generator diode (12) and Mylar shim (13).

6. Remove plastic screw (2) from the plastic stripline cover (1), and install cover.

7. Install plastic screw (2) in stripline cover (1).

8. Reconnect all leads to the power amplifier.

9. Adjust 8411A-A6R14 (power amplifier bias adjust). See adjustment procedure in Paragraph 5-20.

10. Check alignment of 8411A tuning voltage shaping amplifier, Paragraph 5-21.

8-55. Step Generator Diode 8411A-CR1. To replace step generator, perform the following:

a. Remove plastic stripline cover (Figure 8-9, Item 1).

b. Remove step generator diode (12).

c. Install new diode, with Mylar shim (13) positioned as shown in Figure 8-9.

d. Remove plastic screw (2) from the plastic stripline cover (1) and replace cover.

CAUTION

Overtightening plastic screw (2) may damage stripline capacitor C1.

e. Insert plastic screw (2) in stripline cover (1). Tighten only until finger tight.

f. Check alignment of 8411A Tuning Voltage Shaping Amplifier, Paragraph 5-21.

8-56. Stripline in 8411A. To replace stripline, perform the following:

a. Remove metal screws from plastic stripline cover (Figure 8-9, Items 3 and 4) and remove cover.

b. Remove step-recovery diode (12) and Mylar shim (13) under diode.

c. To replace stripline end section:

1. Remove plastic mixer coax clamp (6) and two metal screws (10) from end section of stripline.

2. Unsolder one end of stripline jumper (5) and remove end section of stripline.

3. Insert 0.005-inch-diameter center conductor of drive coax through hole in end section of strip-line.

CAUTION

Center conductor will break with excessive bending.

4. Insert the two metal screws (10) to hold the end section of stripline in place. Do not tighten screws.

NOTE

Use a microscope with vertical illuminator to center the hole over the outer conductor of the drive coax.

5. Carefully center the 0.018-inch-diameter hole in the stripline over the outer conductor of the drive coax and tighten the two metal screws (10) to secure the end section of the stripline.

6. Bend center conductor of drive coax, placing it along center of stripline.

7. Carefully install plastic mixer coax clamp (6) and tighten screw (7).

d. To replace stripline center section:

1. Unsolder one end of each stripline jumper (5) and stripline resistors.

2. Unsolder power amplifier connection to stripline and remove step-recovery diode contact (15 and 16) and stripline center section.

3. Remove pellet resistor (14) from old stripline center section and install on new stripline center section.

4. Insert new stripline center section and hold in place temporarily with three short screws (3).

5. Resolder stripline resistors (8). (Do not add protective coating.)

e. Install step recovery diode (12) with Mylar shim (13) under diode.

f. Remove plastic screw (2) from stripline cover (1).

g. Install plastic stripline cover. Note silicon rubber pad over pellet resistor.

h. Insert plastic screw (2) in stripline cover (1).

i. Perform adjustment procedures, Paragraphs 5-20 and 5-22, then the Performance Tests in Section IV.

8-57. Input Connector 8410B-J1. To replace connector J1, perform the following:

a. To replace an individual cable to 8410B-J1, perform the following procedure:

1. Insert Burndy[1] Tool RX20-25V2 into Connector J1 over pin of cable to be replaced.

2. Force the pin out the rear of the connector.

3. Insert the new pin (with cable attached) into the rear of the connector and force the pin into the connector until it is locked into position.

b. To replace the connector body of 8410B-J1, perform the following procedure:

1. Remove knurled nut on front panel side of connector.

8-58. PRINTED CIRCUIT BOARDS

8-59. The printed circuit boards in the 8410B and 8411A are of the plated through type consisting of metallic conductors bonded to both sides of insulating material. Soldering can be done from either side of the board with equally good results.

Table 8-4 list required tools and materials. Following are recommendations and precautions pertinent to printed circuit repair work.

[1] Burndy Corporation, Norwalk, Connecticut

Table 8-4. Printed Circuit Soldering Equipment

Item	Use	Specification	Item Recommended
Soldering Tool	Soldering Unsoldering	Wattage ratings: 37.5 Tip Temp: 750 - 800° F Tip Size: 1/8" OD	Ungar #776 Handle with Ungar #1237 Heating Unit
Soldering Tip general purpose	Soldering Unsoldering	Shape: chisel Size: 1/8"	Ungar #PL113
De-soldering aid	Unsoldering multi-connection components (e.g., sockets)	Suction device to remove molten solder from connection	Soldapullt by the Edsyn Company, Arleta, California
Resin (flux) solvent	Remove excess flux from soldered area before application of protective coating	Must not dissolve etched circuit base board material or conductor bonding agent	Freon Acetone Lacquer Thinner Isopropyl Alcohol (100% dry)
Solder	Component replacement Circuit board repair Wiring	Resin (flux) core, high tin content (60/40 tin/lead), 18 gauge (SWG) preferred	
Protective Coating	Contamination, corrosion protection after soldering	Good electrical insulation, corrosion-prevention properties	GE Dri-Film 88 General Electric Co. Silicone Products Div. Waterford, N.Y.

a. Avoid unnecessary component substitution; it can result in damage to the circuit board and adjacent components.

b. Do not use a high-power soldering iron. Excessive heat may lift a conductor or damage the board.

c. Use a suction device (Table 8-4) or wooden toothpick to remove solder from component mounting holes. DO NOT USE A SHARP METAL OBJECT SUCH AS AN AWL OR TWIST DRILL FOR THIS PURPOSE. SHARP OBJECTS MAY DAMAGE THE PLATED-THROUGH CONDUCTOR.

d. After soldering, remove excess flux from the soldered area and apply a protective coating to prevent contamination and corrosion. See Table 8-4 for recommendations.

8-60. A broken or burned section of conductor can be repaired by bridging the damaged section with a length of tinned copper wire. Allow adequate overlap and remove any varnish from etched conductor before soldering wire into place.

8-61. Component Replacement. A general procedure for replacing a component is as follows:

a. Remove defective component from circuit board.

b. Remove solder from mounting holes using a suction desoldering aid (Table 8-4 or wooden toothpick.

c. Shape leads of replacement component to match mounting hole spacing.

d. Insert component leads into mounting holes and position component as original was positioned. DO NOT FORCE LEADS OF REPLACEMENT COMPONENT INTO MOUNTING HOLES. Sharp lead ends may damage plated-through conductor.

NOTE

Axial lead components, such as resistors and tubular capacitors, can be replaced without unsoldering. Clip leads near body of defective component, remove component and straighten leads left in board. Wrap leads of replacement component one turn around original leads. Solder wrapped connection and clip off excess lead.

8-62. Transistor Replacement. A general procedure for replacing a transistor is as follows:

a. Do not apply excessive heat. See Table 8-4 for soldering tool specifications.

b. Use a heat sink such as pliers or hemostat between transistor body and hot soldering iron.

c. When installing a replacement transistor, ensure sufficient lead length to dissipate heat of soldering by maintaining about the same length of exposed lead as used for original transistor.

8-63. Diode Replacement. Solid state diodes are in many physical forms. This sometimes results in confusion as to which lead or connection is for the cathode (negative) or anode (positive), since not all diodes are marked with the standard symbols. Figure 8-4 shows examples of some diode marking methods. If doubt exists as to polarity, an ohmmeter may be used to determine the proper connection. It is necessary to know the polarity of the ohms lead with respect to the common lead for the ohmmeter used. Ohms lead polarities for some common ohmmeters are shown in Table 8-4. When the ohmmeter indicates the least diode resistance, the cathode of the diode is connected to the ohmmeter lead which is negative with respect to the other lead.

NOTE

Diode replacement instructions are the same as those for transistor replacement.

8-64. SCHEMATIC DIAGRAMS.

8-65. The schematic diagrams in this section represent the circuits electrically. They are not wiring diagrams, though wire colors are given when practical.

8-66. The circuits are arranged according to signal flow; consequently, some switch and circuit

assemblies may be shown in part on more than one diagram. If so, the reference designation is preceded by P/O, for "Part Of", and is followed by a notation of the number of parts into which the assembly has been divided.

8-67. Service Sheet numbers are used to cross reference connections between schematics. A list of the service sheets and the assemblies shown on the drawings is listed in Table 8-1.

8-68. Some of the general information obtainable from the schematic diagrams is shown in Figure 8-11. Notes and explanations of symbols pertaining to all the diagrams are contained in Figure 8-12. Figure 8-12 also contains the test setup and measurement conditions required to obtain the normal test point waveforms and voltages noted on the schematic diagrams. Notes about specific components, circuits, or conditions are given on the diagram to which they apply.

8-69. As an aid to finding components and assemblies in the set of diagrams, each diagram has a box labelled Reference Designations that contains all the reference designations appearing on the diagram.

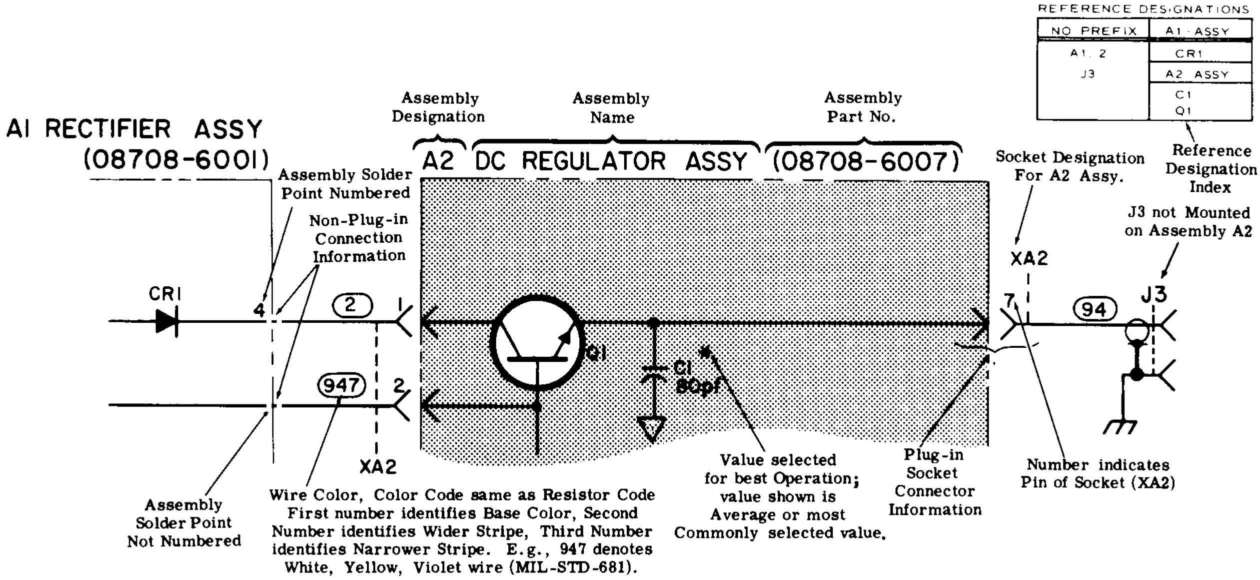


Figure 8-11. General Information on Schematic Diagrams

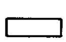
1. Resistance is in ohms and capacitance is in microfarads unless otherwise noted.

2. P/O = part of.

3. *Asterisk denotes a factory-selected value. Value shown is typical. Capacitors may be omitted or resistors jumpered.

4.  Screwdriver adjustment.

    Panel control.

5.  Encloses front panel designations.

    Encloses rear panel designation.

6. ———— — — ———— Circuit assembly borderline.

   — — — — — — — Other assembly borderline.

Figure 8-12. Schematic Diagram Notes (Sheet 1 of 3)

7.  Heavy line with arrows indicates path and direction of main signal.

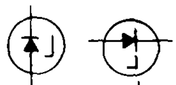
 Heavy dashed line with arrows indicates path and direction of main feedback.

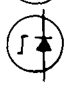
8. 

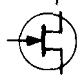
Wiper moves toward CW with clockwise rotation of control as viewed from shaft or knob.

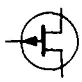
9.  Numbers in circles on circuit assemblies show locations of test points.

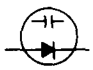
10.  Encloses wire color code. Code used (MIL-STD-681) is the same as the resistor color code. First number indentifies the base color, second number the wider stripe, and the third number identifies the narrower stripe. E.g., (947) denotes white base, yellow wide stripe, violet narrow stripe.

11.  Voltage regulator (breakdown diode).

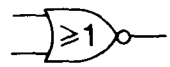
 Step recovery diode.

 Field effect transistor with N-type base.

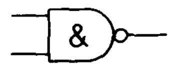
 Field effect transistor with P-type base.

 Capacitive diode (Varicap, varactor).

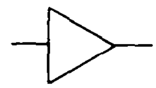
GENERAL LOGIC ELEMENTS

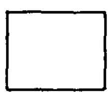


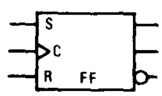
NOR Gate



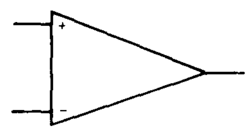
NAND Gate

 Buffer

 General Element



Flip-Flop



Operational Amplifier

12. CONDITIONS FOR DC VOLTAGE AND WAVEFORM MEASUREMENT

a. LINE VOLTAGE: 100, 120, 220, or 240 VAC, +5% -10%, 50 to 60 Hz.

b. 8410B CONTROL SETTINGS

FREQ RANGE (GHz)	to include frequency applied to 8411A inputs
SWEEP STABILITY	CW detent
TEST CHANNEL GAIN	69
AMPL VERNIER	max. clockwise
PHASE VERNIER	centered (approximately)

c. Connect equipment as shown in standard test setup. Adjust signal source for a power level of -30 dBm at the 8411A REFERENCE port and -10 dBm at the 8411A TEST port. Amplitudes given throughout the 8410B and 8411A assume these power levels at the 8411A input ports.

d. To check SEARCH waveforms, disconnect RF input from signal source and set 8410B FREQ RANGE switch to maximum clockwise position (0.1 to 0.25 GHz).

e. To view most waveforms in the 8411A, an Oscilloscope or Spectrum Analyzer must be used. Waveforms shown on the 8411A schematics are obtained using Oscilloscope HP Model 1740A. Waveforms at the stripline, power amplifier, and VTO are taken using a blocking capacitor, HP 10217A, at the end of the probe. Information is also given in the troubleshooting procedure for using SPECTRUM Analyzer HP Model 8565A.

Figure 8-12. Schematic Diagram Notes (Sheet 2 of 3)

f. DC voltages shown on the schematic diagrams should be taken with a digital voltmeter with 10 megohm input impedance and 0.05% accuracy.

g. Some of the dc voltages in 8410B-A7 and 8410B-A8 are shown as fractions. The numerator is the voltage during search conditions (no RF input signal to 8411A). The denominator is the voltage during phase-locked condition.

h. DC voltages at 8410B-A4 and 8410B-A5 are taken with 8411A disconnected from 8410B.

STANDARD TEST SETUP FOR SCHEMATIC WAVEFORMS AND VOLTAGES

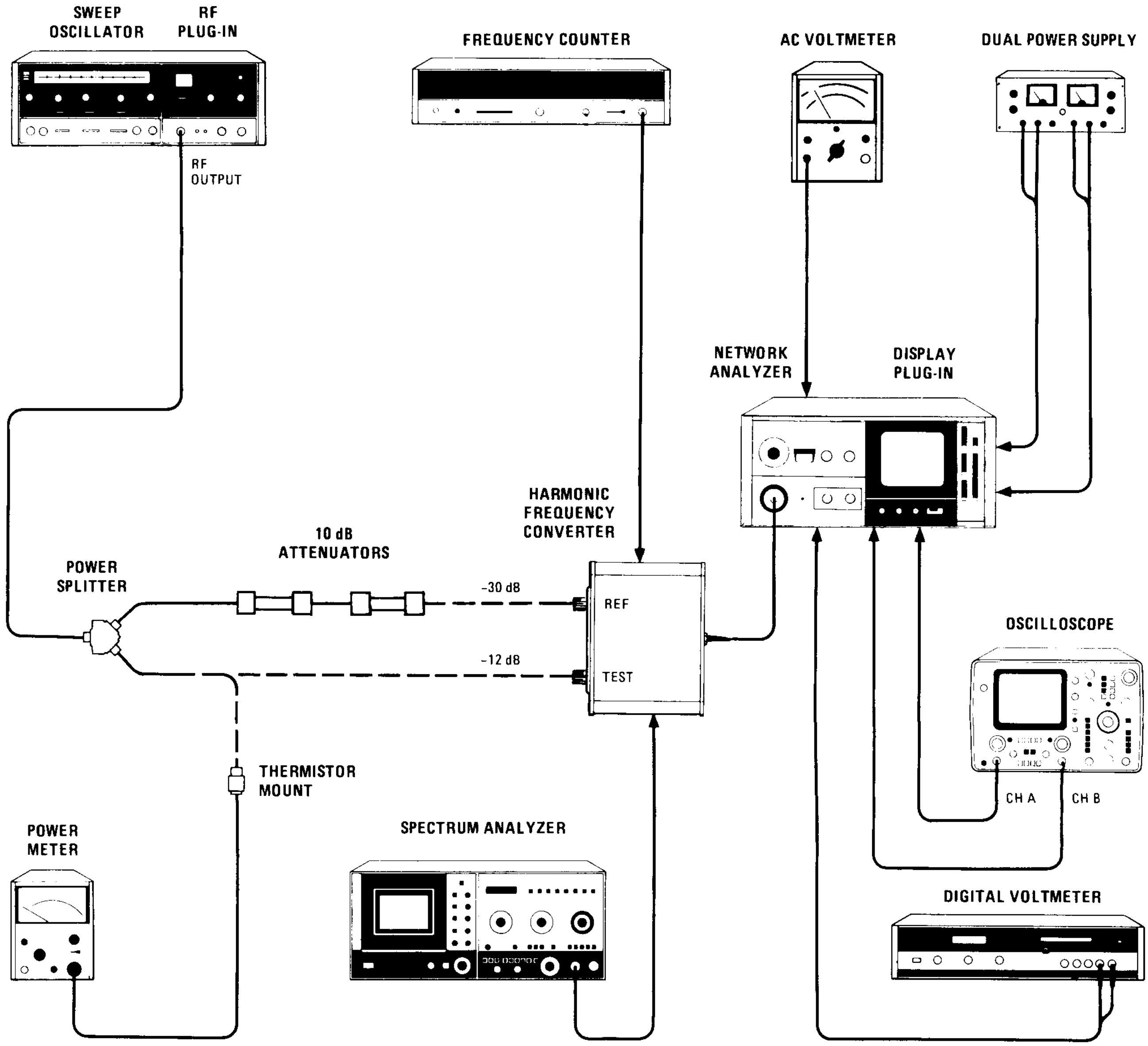


Figure 8-12. Schematic Diagram Notes (Sheet 3 of 3)

8410B TROUBLESHOOTING PROCEDURE

DESCRIPTION

If the 8410B has trouble phase locking or tracking over single octave or multioctave bands, the following troubleshooting procedure should be followed. The troubleshoooting is divided into two parts. Part I tests the A19 Frequency Range Assembly and part of the A18 A/D Converter Assembly used in both AUTO mode and for selected frequency ranges. Part II tests the A9 Automatic Control Assembly and part of the A18 A/D Converter used in AUTO mode only.

PART I

TEST SETUP



NOTE: Use floating terminals on Digital Voltmeter.

TEST EQUIPMENT: Item 11, Table 1-8.

PROCEDURE

a. Check overall frequency range selection as follows:
   1. Remove A9 Automatic Control Assembly.
   2. Position A19S1 to TEST.
   3. Stepping FREQ RANGE (GHz) control through all frequency range positions, make resistance checks designated in the table below.

      NOTE

      Use 10K ohms fullrange display on Digital Voltmeter. Improper range selection may result in inaccurate readings.

   4. If the resistance check is good, proceed to Part II of the troubleshooting procedure. If the resistance check is incorrect, proceed to Part I, step b.

b. Set FREQ RANGE (GHz) control to the position where an incorrect indication was found in step a. Make voltage checks at the designated test points in the following table.

Figure 8-13. 8410B Troubleshooting Procedures (Sheet 1 of 5)

PART I (Con't.)

RESISTANCE (OHMS)

FREQ RANGE (GHz)	A19TP5 to A19TP2			A19TP4 to A19TP3		
	LOW	NOMINAL	HIGH	LOW	NOMINAL	HIGH
0.1 – 0.25	3.318K	3.528K	3.743K	37	56	84
0.18 – 0.35	1.705K	1.816K	1.930K	56	75	105
0.25 – 0.5	1.110K	1.185K	1.264K	114	137	170
0.35 – 0.7	612	657	706	321	357	402
0.5 – 1.0	481	518	559	411	452	504
0.7 – 1.4	292	318	348	573	624	685
1.0 – 2.0	269	293	322	733	794	865
1.4 – 2.8	193	213	237	1.188K	1.276K	1.375K
2.0 – 4.0	151	168	190	1.492K	1.599K	1.717K
2.8 – 5.7	118	134	154	2.263K	2.418K	2.583K
4.0 – 8.0	87	100	119	3.046K	3.250K	3.463K
5.7 – 11.3	70	83	100	4.825K	5.138K	5.462K
8.0 – 16.0	54	65	82	6.423K	6.838K	7.264K
11.3 – 18.0	40	51	67	8.568K	9.118K	9.682K

TEST POINT VOLTAGE

TEST POINT	FREQ RANGE (GHZ)													
	0.1-0.25	0.18-0.35	0.25-0.5	0.35-0.7	0.5-1.0	0.7-1.4	1.0-2.0	1.4-2.8	2.0-4.0	2.8-5.7	4.0-8.0	5.7-11.3	8.0-16.0	11.3-18.0
A18TP2	+12V	+12V	0V	0V	+12V	+12V	0V	0V	+12V	+12V	0V	0V	+12V	+12V
A18TP3	+12V	+12V	+12V	+12V	+12V	+12V	+12V	+12V	0V	0V	0V	0V	0V	0V
A18TP4	0V	0V	0V	0V	0V	0V	0V	0V	+12V	+12V	+12V	+12V	+12V	+12V
A18TP5	+12V	0V	+12V	0V	+12V	0V	+12V	0V	+12V	0V	+12V	0V	+12V	0V
A18TP6	+12V	+12V	+12V	+12V	0V	0V	0V	0V	+12V	+12V	+12V	+12V	0V	0V

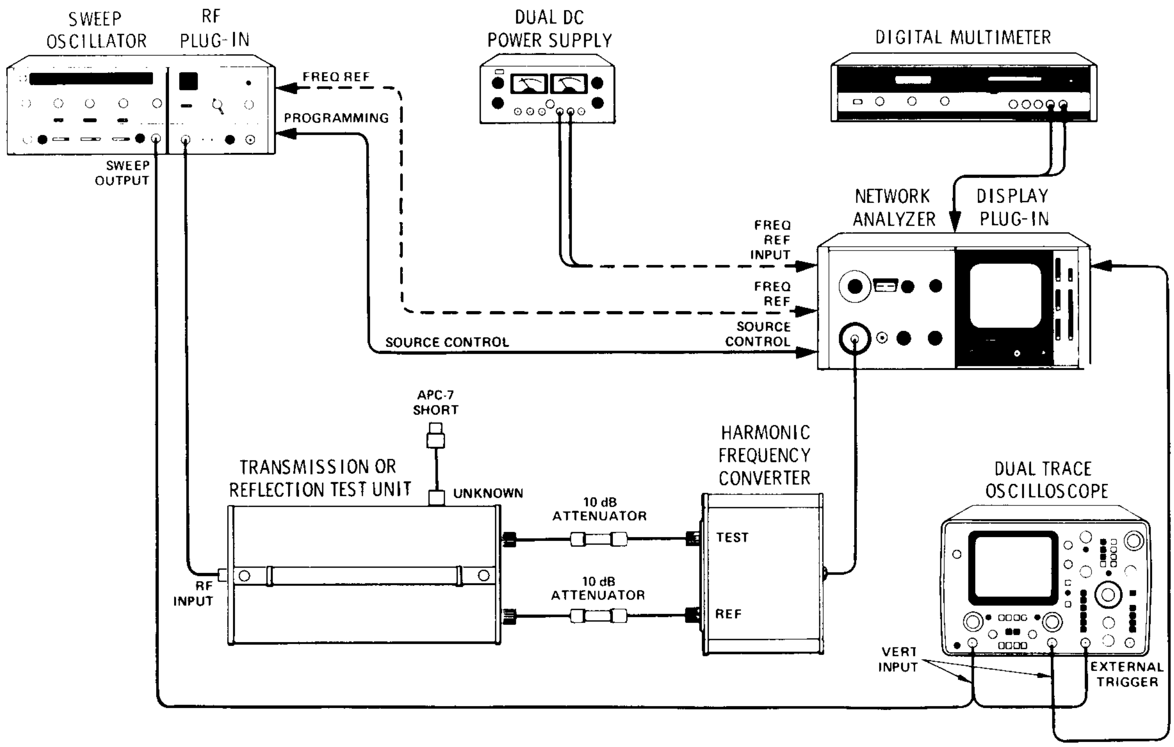
c. If Part I, step B checks good, the problem is on the A19 Frequency Range Assembly. If Part I, step B check indicates incorrect, the problem is on the A18 A/D Converter Assembly.

d. Reinstall A9 Automatic Control Assembly and return A18S1 to NORMAL position.

Figure 8-13. 8410B Troubleshooting Procedures (Sheet 2 of 5)

8410B TROUBLESHOOTING PROCEDURE

PART II



TEST EQUIPMENT: Items 1, 4, 5, 9, 11, 16, and 20, Table 1-8.

PROCEDURE

CAUTION

Do not apply more than +20V to FREQ REF INPUT.

a. Ground A18TP7 and connect the power supply to FREQ REF INPUT.
b. Check the A/D Converter Assembly as follows:
   1. Check the Multiplexer output voltages for the corresponding Frequency Reference Input voltages given in the table below. If the Multiplexer output voltages are correct, proceed to Part II, step c. If voltages are incorrect proceed to Part II, step b-2.
   2. Set the FREQ REF INPUT voltage for the incorrect Multiplexer output voltage indication obtained in Part II, step b-1. Check the corresponding Latch output voltages shown in the table below.

Figure 8-13. 8410B Troubleshooting Procedures (Sheet 3 of 5)

PART II (Cont'd)

3. If the Latch output voltages are incorrect, the trouble is in the Log A/D Converter or Latch circuitry. If the Latch output voltages are correct, the trouble is in the Encoder or Multiplexer circuitry.

MULTIPLEXER OUTPUTS

FREQ REF INPUT	A18TP2	A18TP3	A18TP4	A18TP5	A18TP6
+0.1V	+12V	+12V	0V	+12V	+12V
+0.2V	+12V	+12V	0V	0V	+12V
+0.3V	0V	+12V	0V	+12V	+12V
+0.4V	0V	+12V	0V	0V	+12V
+0.6V	+12V	+12V	0V	+12V	0V
+0.8V	+12V	+12V	0V	0V	0V
+1.2V	0V	+12V	0V	+12V	0V
+1.7V	0V	+12V	0V	0V	0V
+2.4V	+12V	0V	+12V	+12V	+12V
+3.4V	+12V	0V	+12V	0V	+12V
+4.8V	0V	0V	+12V	+12V	+12V
+7.0V	0V	0V	+12V	0V	+12V
+9.5V	+12V	0V	+12V	+12V	0V
+11.5V	+12V	0V	+12V	0V	0V

LATCH OUTPUTS

FREQ REF INPUT	A8U5	A18U6				A18U9				A18U10			
	Pin 1	Pin 1	Pin 11	Pin 10	Pin 2	Pin 1	Pin 11	Pin 10	Pin 2	Pin 1	Pin 11	Pin 10	Pin 2
+0.1V	0V	0V	0V	0V	0V	0V	0V	0V	0V	0V	0V	0V	0V
+0.2V	0V	0V	0V	0V	0V	0V	0V	0V	0V	0V	0V	0V	+12V
+0.3V	0V	0V	0V	0V	0V	0V	0V	0V	0V	0V	0V	+12V	+12V
+0.4V	0V	0V	0V	0V	0V	0V	0V	0V	0V	0V	+12V	+12V	+12V
+0.6V	0V	0V	0V	0V	0V	0V	0V	0V	0V	+12V	+12V	+12V	+12V
+0.8V	0V	0V	0V	0V	0V	0V	0V	0V	+12V	+12V	+12V	+12V	+12V
+1.2V	0V	0V	0V	0V	0V	0V	0V	+12V	+12V	+12V	+12V	+12V	+12V
+1.7V	0V	0V	0V	0V	0V	0V	+12V	+12V	+12V	+12V	+12V	+12V	+12V
+2.4V	0V	0V	0V	0V	0V	+12V	+12V	+12V	+12V	+12V	+12V	+12V	+12V
+3.4V	0V	0V	0V	0V	+12V	+12V	+12V	+12V	+12V	+12V	+12V	+12V	+12V
+4.8V	0V	0V	0V	+12V	+12V	+12V	+12V	+12V	+12V	+12V	+12V	+12V	+12V
+7.0V	0V	0V	+12V	+12V	+12V	+12V	+12V	+12V	+12V	+12V	+12V	+12V	+12V
+9.5V	0V	+12V	+12V	+12V	+12V	+12V	+12V	+12V	+12V	+12V	+12V	+12V	+12V
+11.5V	+12V	+12V	+12V	+12V	+12V	+12V	+12V	+12V	+12V	+12V	+12V	+12V	+12V

c. Remove ground from A18TP7 and disconnect power supply.
d. Connect FREQ REF INPUT from sweep oscillator and set FREQ RANGE (GHz) control to AUTO.
e. Set the sweep oscillator to sweep over more than one octave band (Example 2GHz to 6 GHz)

Figure 8-13. 8410B Troubleshooting Procedures (Sheet 4 of 5)

f. With Channel A of the oscilloscope connected to the 8620C SWEEP OUT, connect Channel B to the test points designated in the timing diagram below. Set oscilloscope for a chopped display and negative trigger slope. Check that the two triggers and the leading edges of each pulse coincide (except HOLD ALLOW, which may remain high (+10V) for more than one trigger).

NOTE

If an 86290A RF section is not used, the sequential break points at 6.2 GHz and 12.4 GHz will not be present.

g. If Part II step f check indicates incorrect, the problem is in the A9 Automatic Control Assembly or the control signals fed to it.

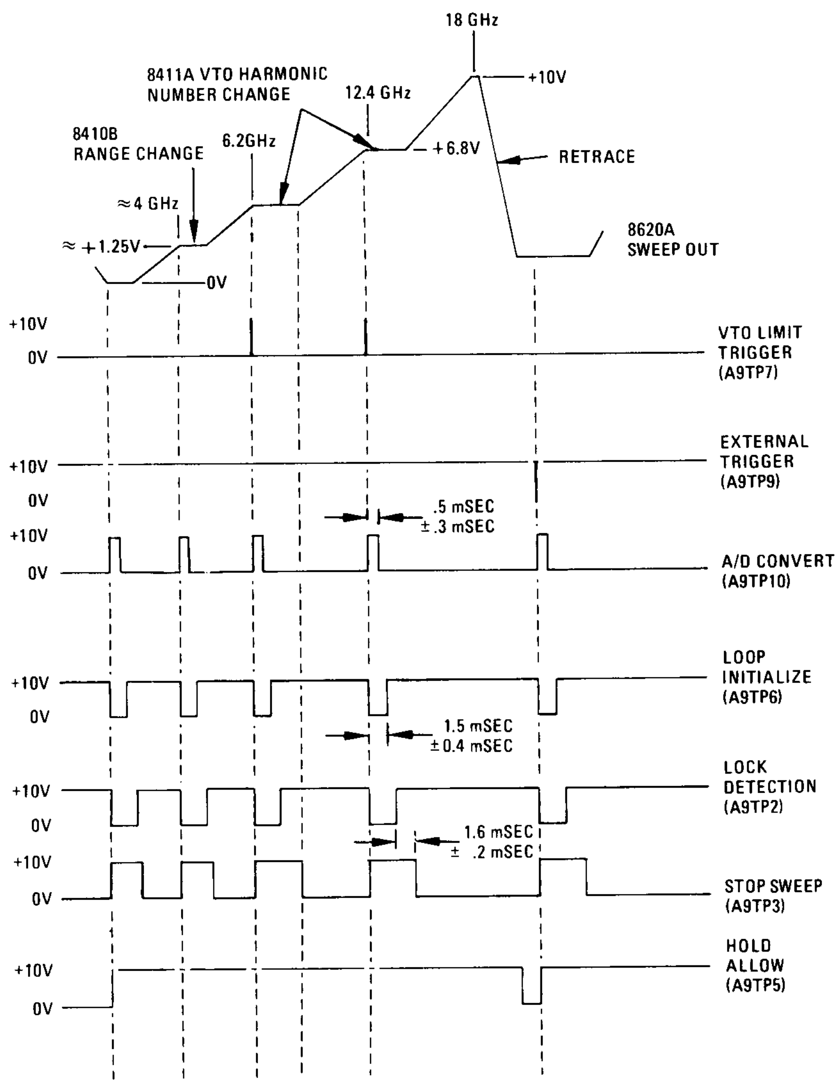


Figure 8-13. 8410B Troubleshooting Procedures (Sheet 5 of 5)

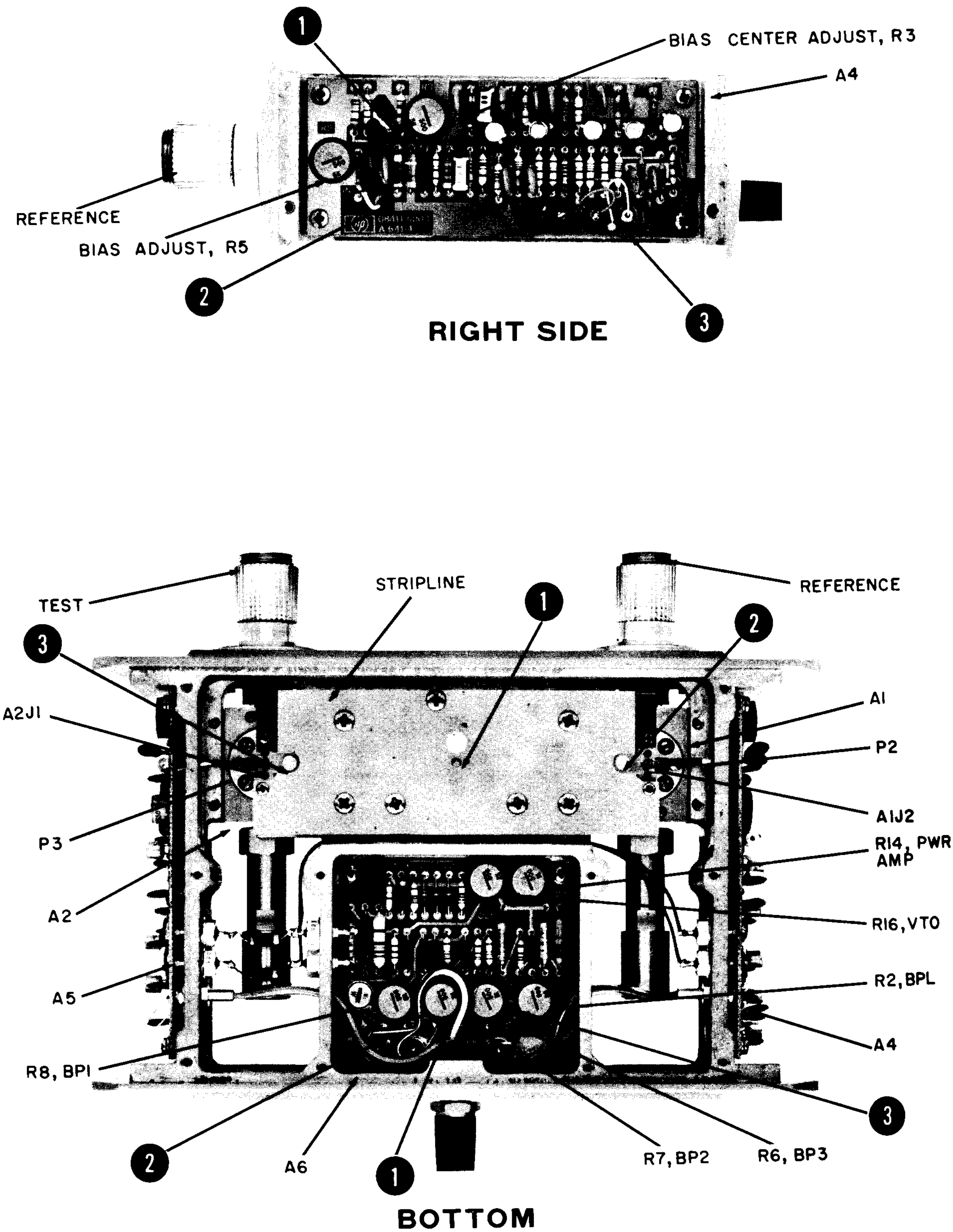
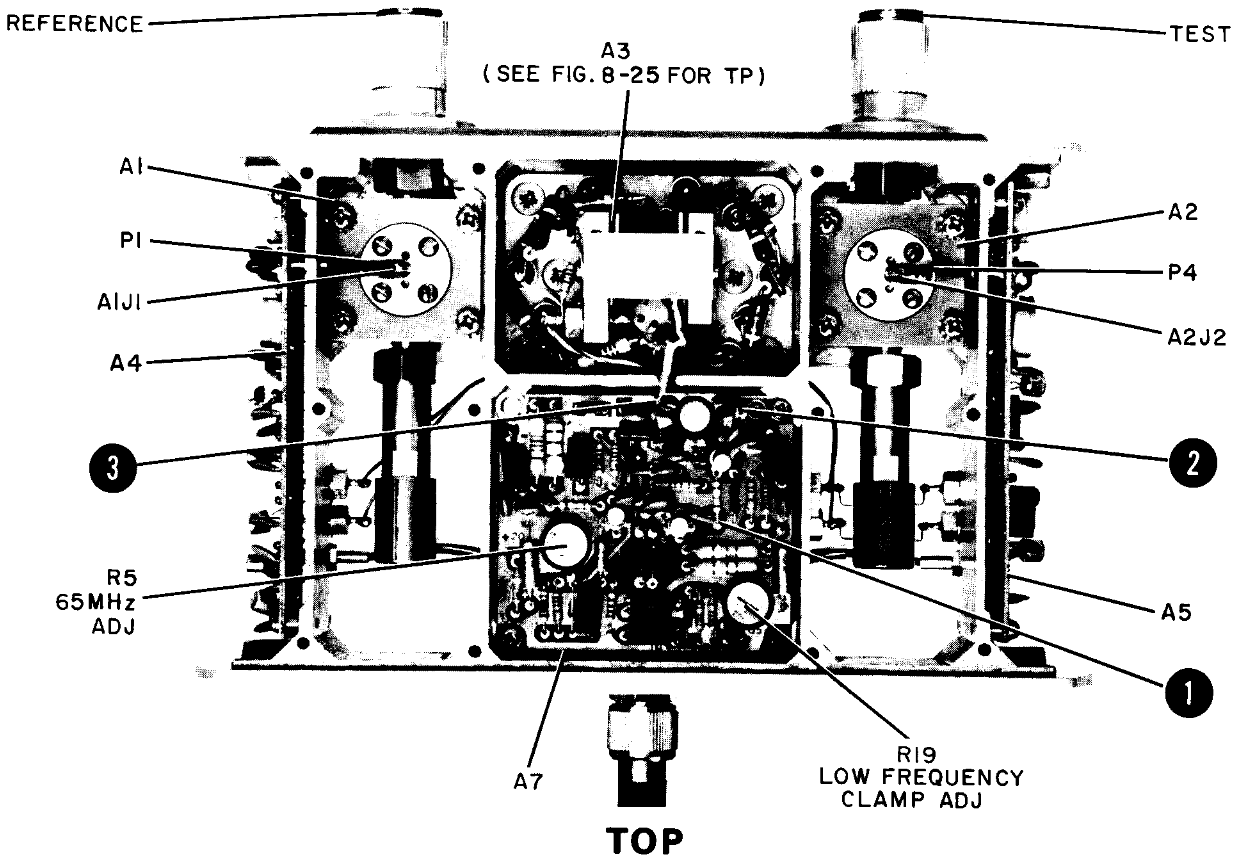


Figure 8-16. Models 8410B/8411A Interface Test Points (2 of 2)



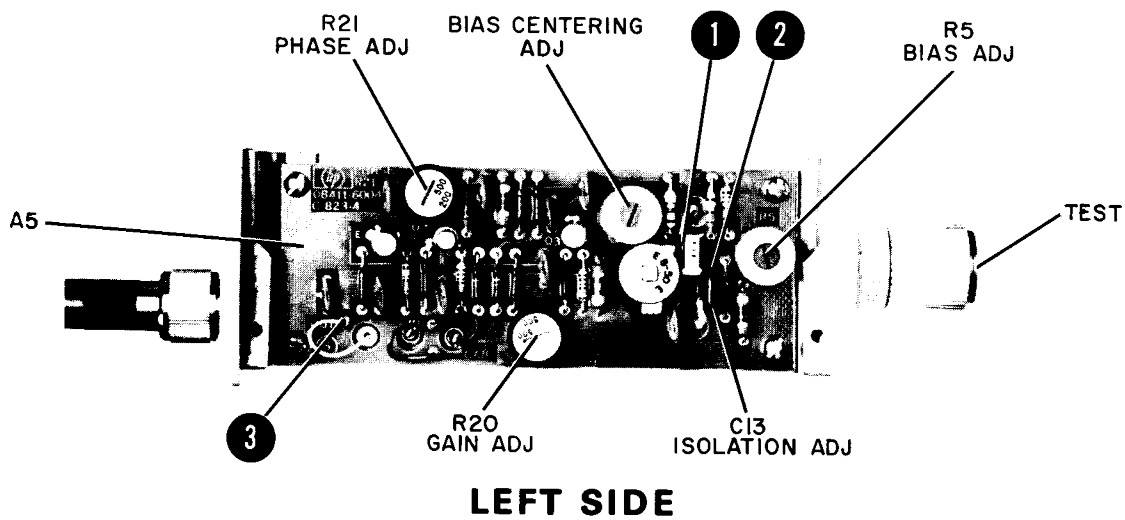
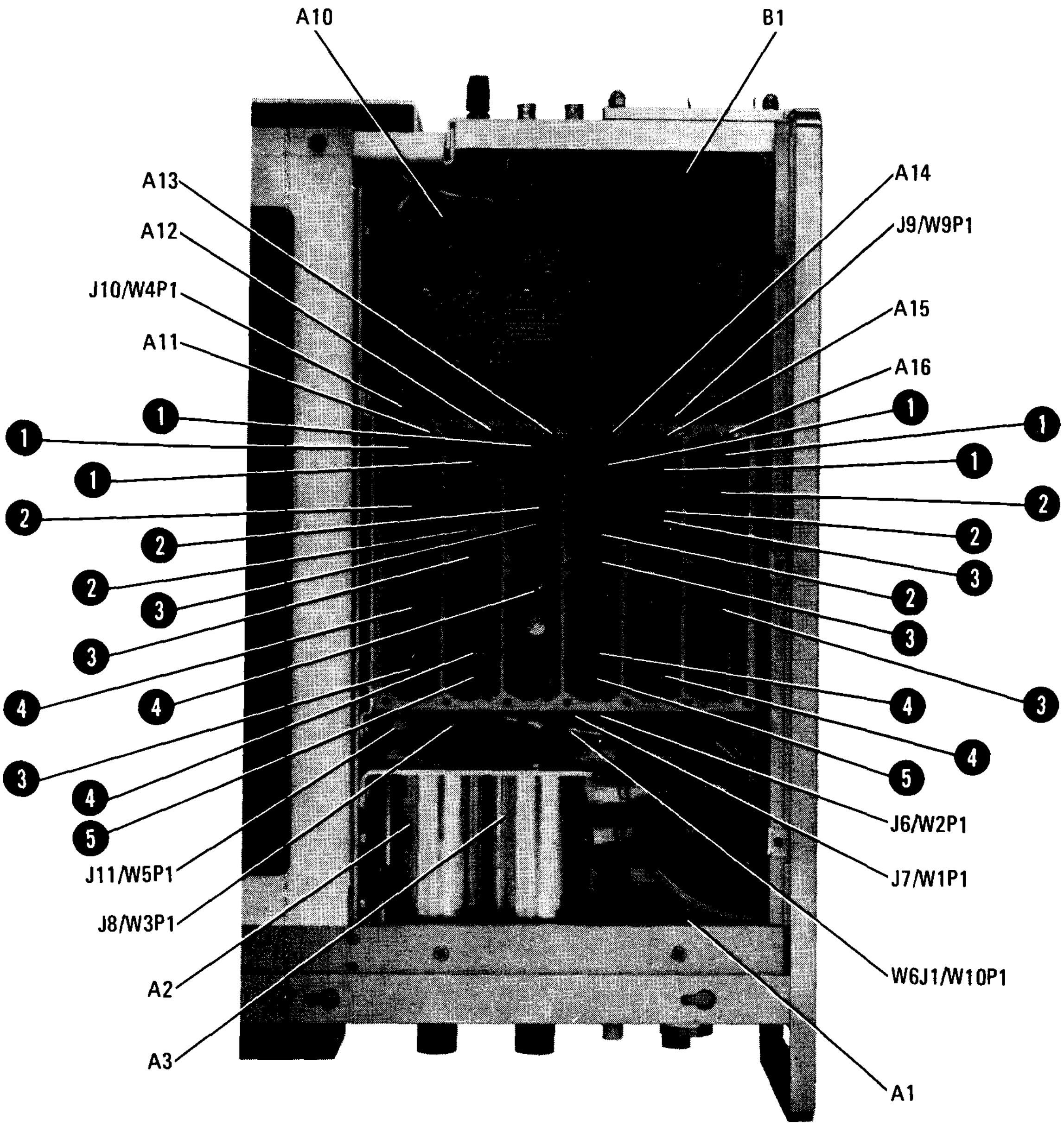


Figure 8-16. Models 8410B/8411A Interface Test Points (1 of 2)



BOTTOM VIEW

Figure 8-15. Model 8410B Test Points (2 of 2)

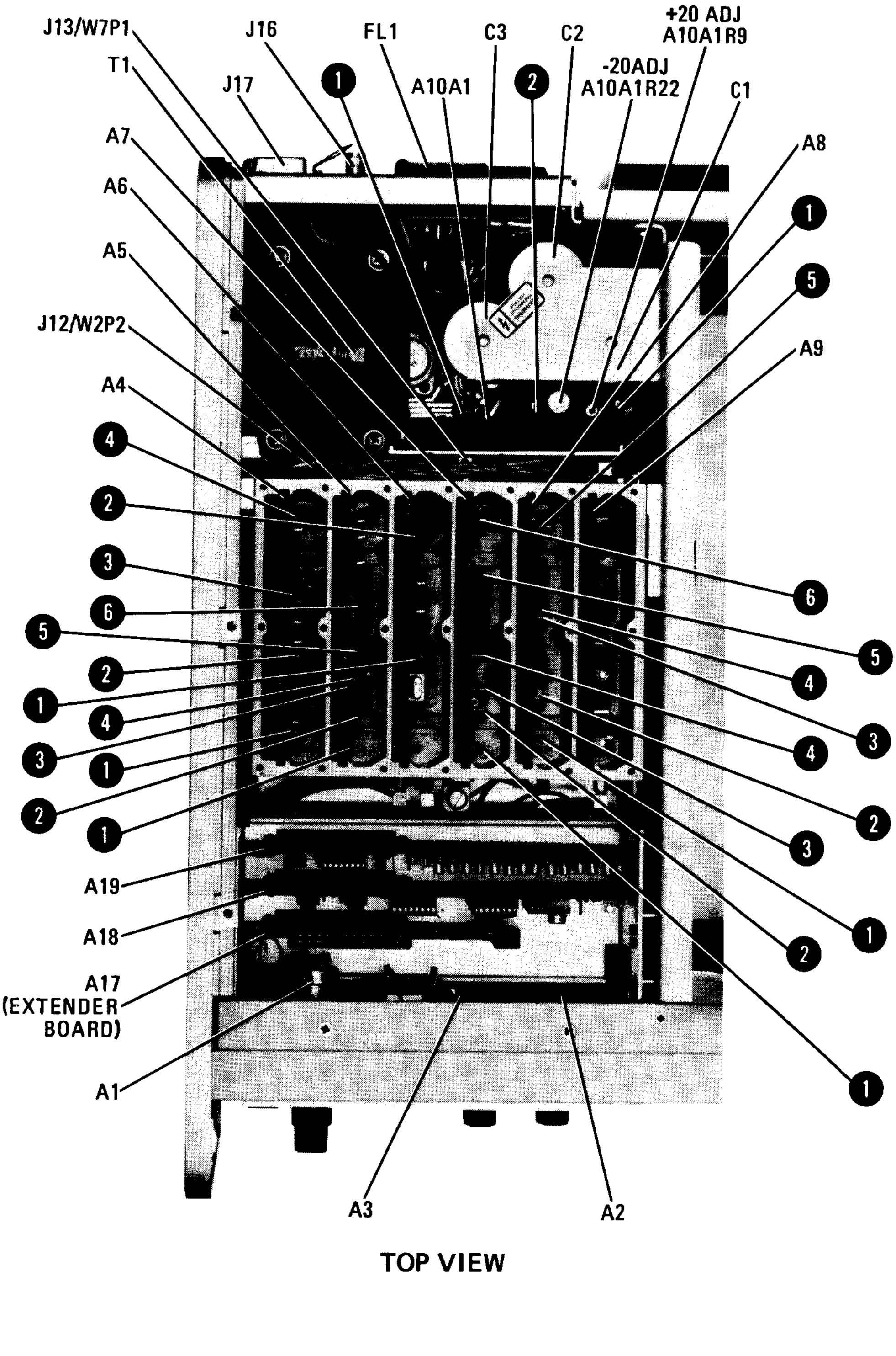


Figure 8-15. Model 8410B Test Points (1 of 2)

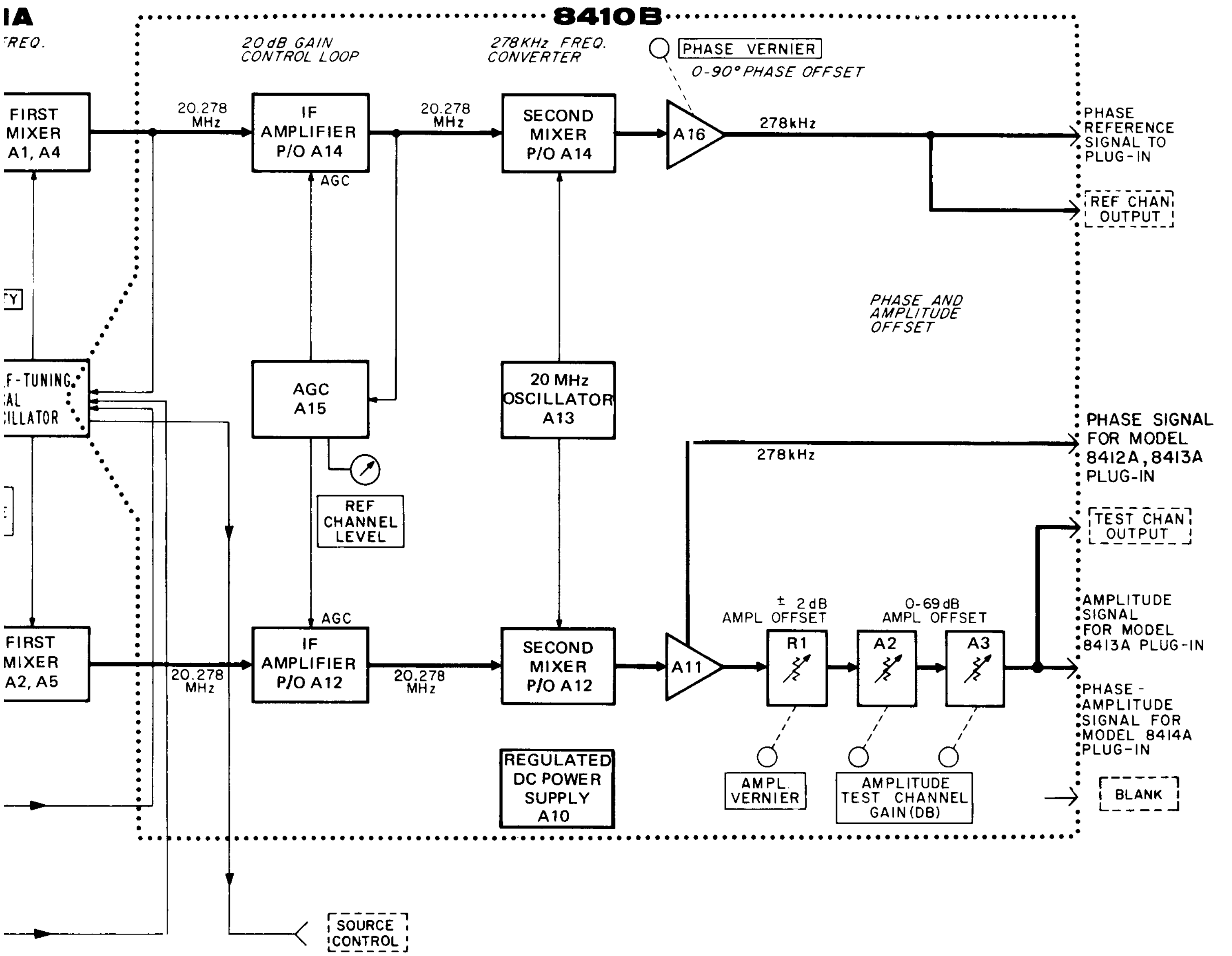
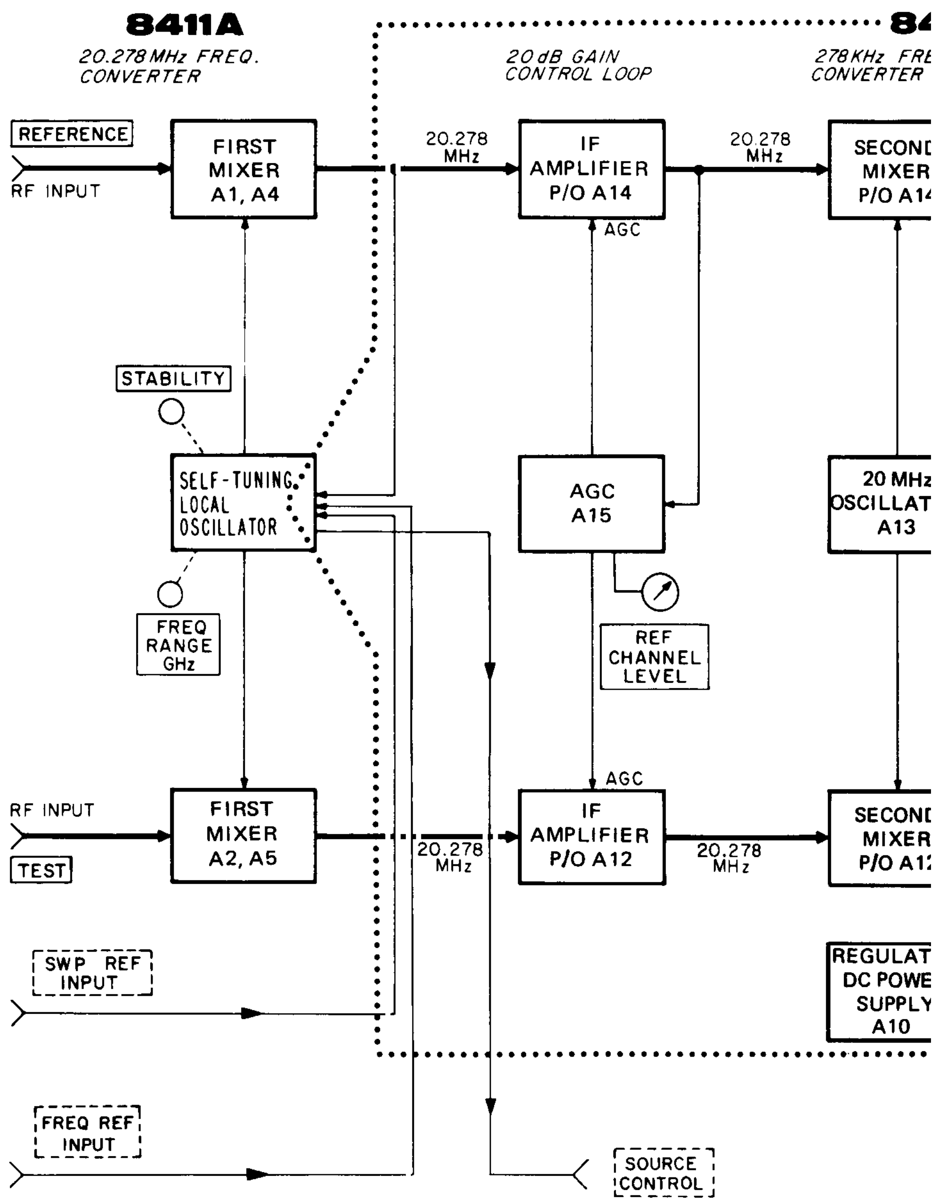
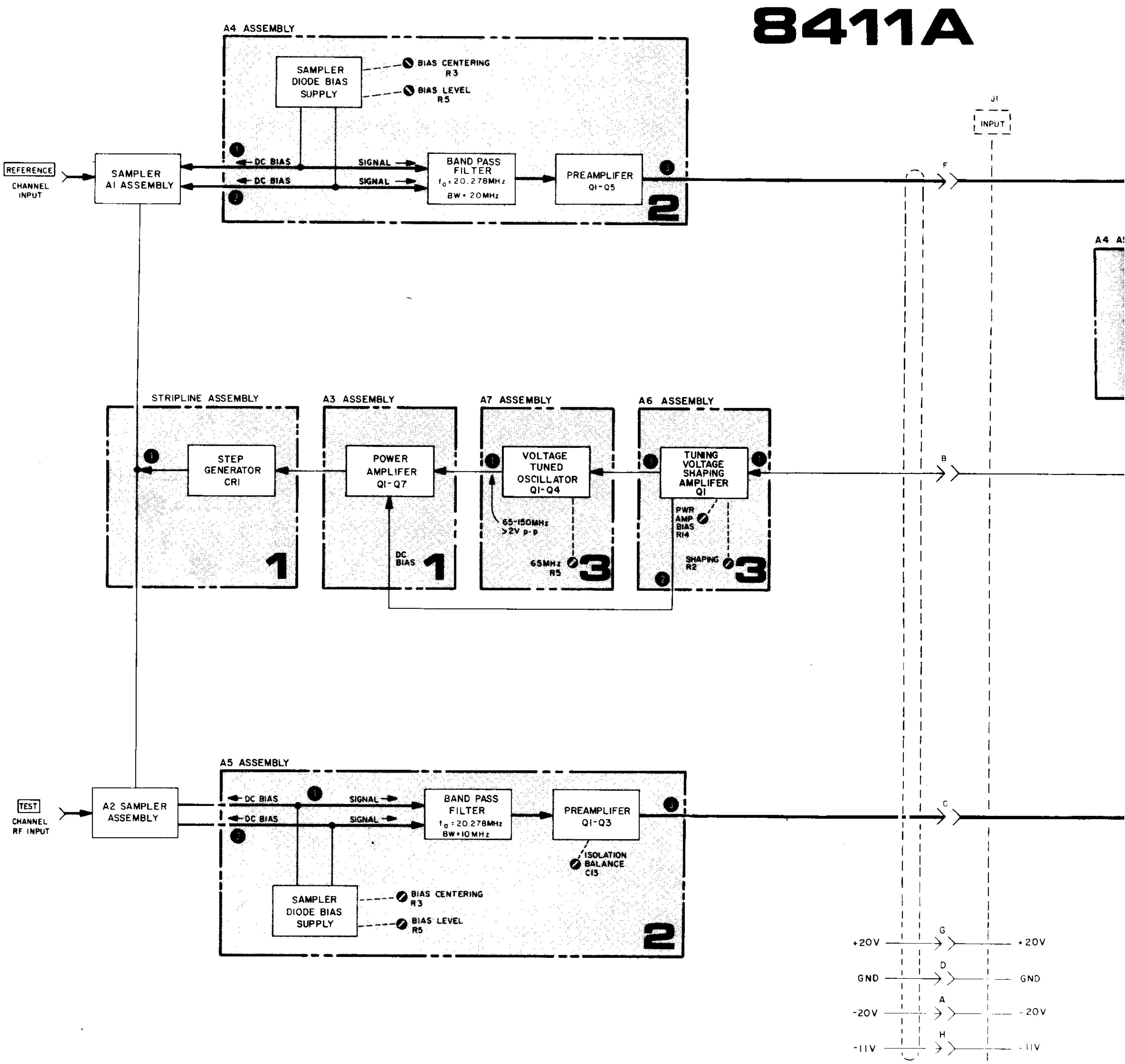


Figure 8-14. Basic Block Diagram

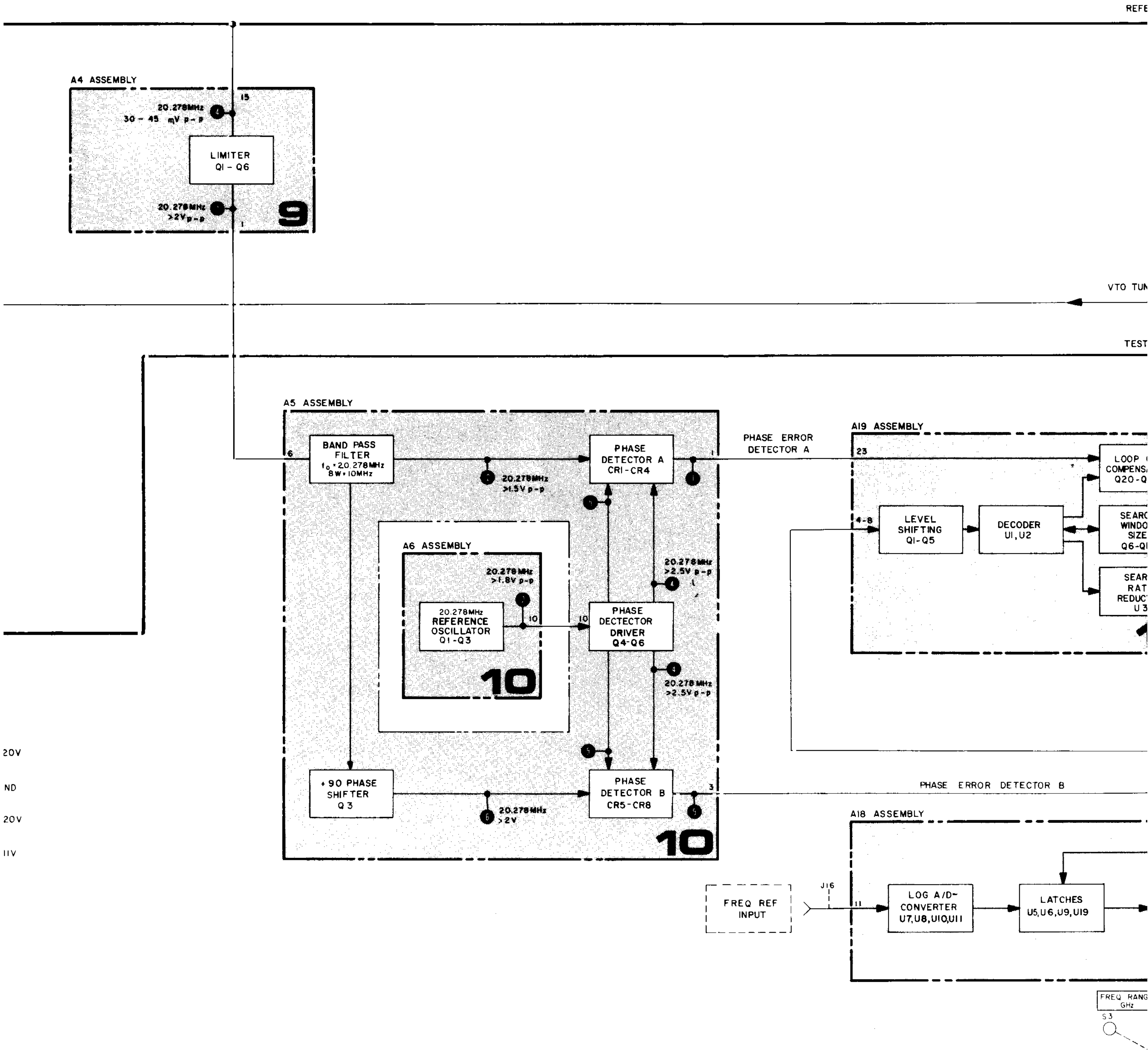


8411A
20.278 MHz FREQ. CONVERTER
20 dB GAIN CONTROL LOOP
278 KHz FRE
CONVERTER
REFERENCE
RF INPUT
FIRST MIXER A1, A4
20.278 MHz
IF AMPLIFIER P/O A14
AGC
STABILITY
SELF-TUNING LOCAL OSCILLATOR
FREQ RANGE GHz
AGC A15
REF CHANNEL LEVEL
20 MHz
A13
RF INPUT
TEST
FIRST MIXER A2, A5
IF AMPLIFIER P/O A12
SWP REF INPUT
FREQ REF INPUT
SOURCE CONTROL
DC POWE
SUPPLY
A10



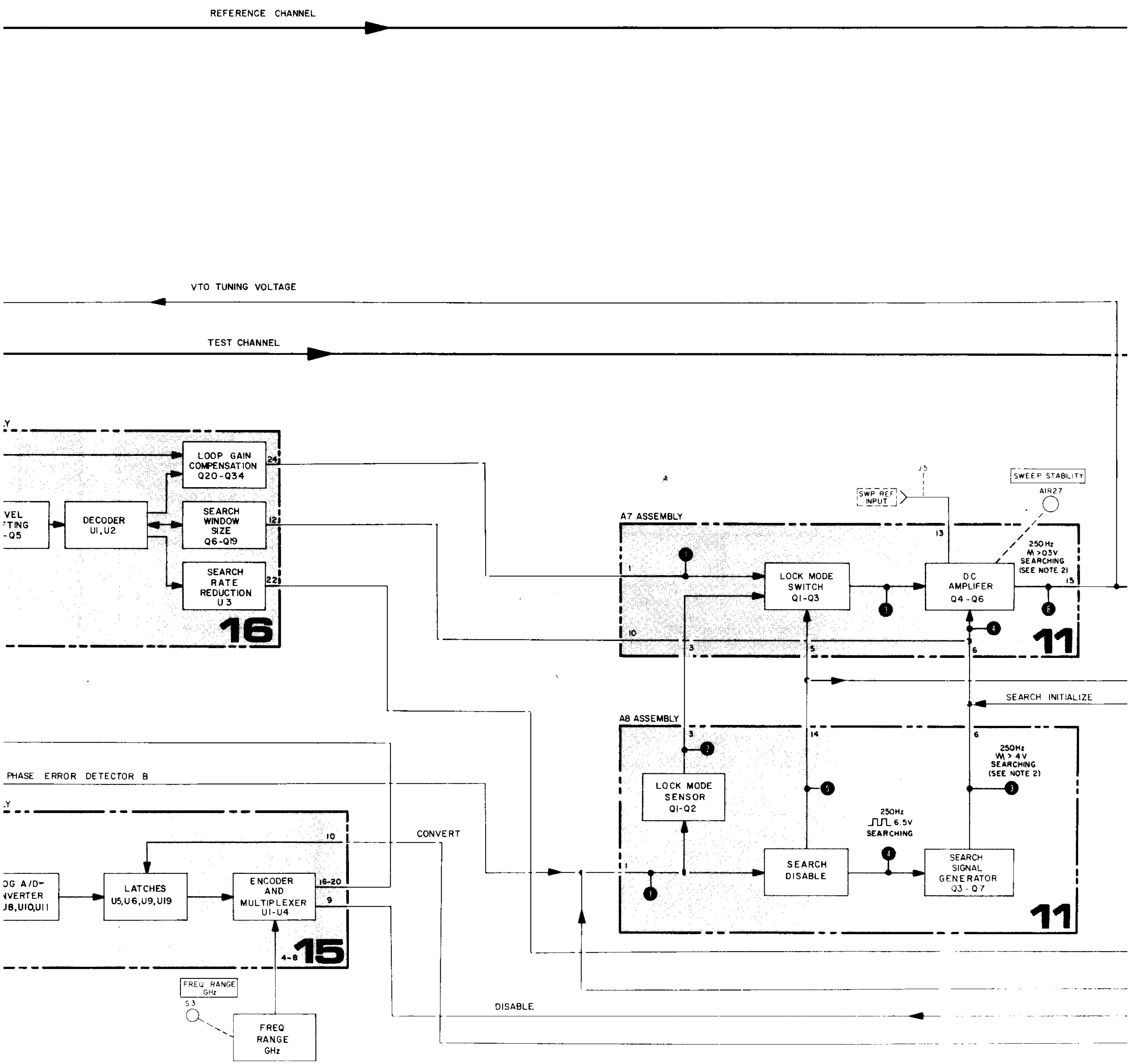
NOTES

1. SEE FIGURE 8-12 FOR MEASUREMENT INFORMATION AND TEST CONDITIONS.
2. WAVEFORM AT A7TP6, A8TP3, AND A8TP4 ARE TAKEN WITH NO RF SIGNAL APPLIED AT INPUT OF 8411A. AMPLITUDE AT A7TP6 IS GIVEN WITH FREQUENCY RANGE SWITCH SET AT .01 TO 0.25 GHz. A HIGHER FREQUENCY SETTING SHOULD DECREASE AMPLITUDE.

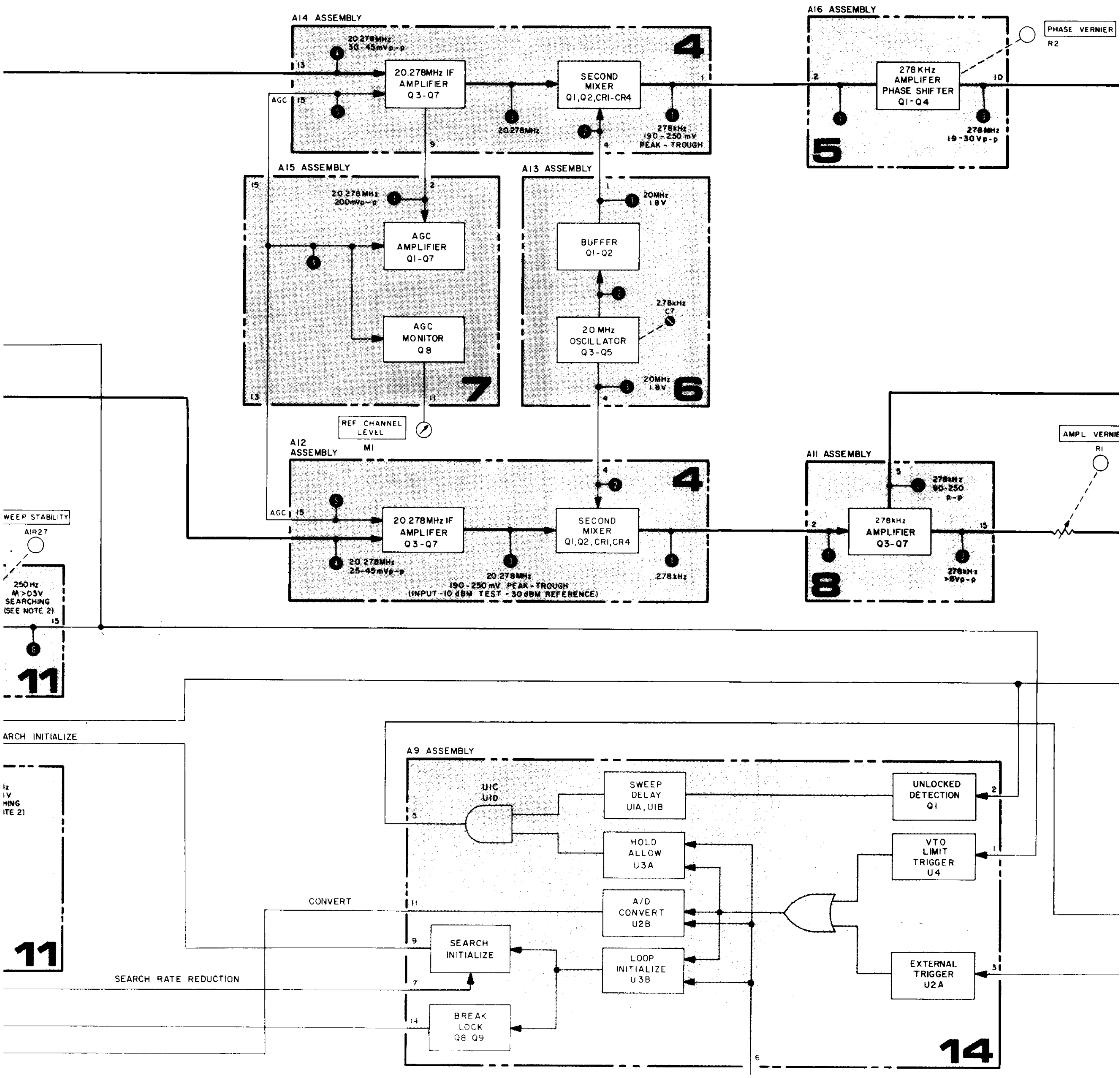


REFE
A4 ASSEMBLY
20.278MHz
30 - 45 mV p-p
15
LIMITER
Q1 - Q6
20.278MHz
>2Vp-p
1
9
VTO TUN
TEST
A5 ASSEMBLY
BAND PASS
FILTER
fo = 20.278MHz
BW = 10MHz
6
20.278MHz
>1.5V p-p
PHASE
DETECTOR A
CR1-CR4
1
PHASE ERROR
DETECTOR A
A6 ASSEMBLY
20.278MHz
>1.8V p-p
20.278MHz
REFERENCE
OSCILLATOR
Q1-Q3
10
10
20.278MHz
>2.5V p-p
PHASE
DECTECTOR
DRIVER
Q4-Q6
20.278 MHz
>2.5V p-p
10
+90 PHASE
SHIFTER
Q3
20.278MHz
>2V
PHASE
DETECTOR B
CR5-CR8
3
10
PHASE ERROR DETECTOR B
A19 ASSEMBLY
23
LOOP
COMPENSA
Q20-Q
4-8
LEVEL
SHIFTING
Q1-Q5
DECODER
U1, U2
SEARC
WINDO
SIZE
Q6-Q
SEAR
RAT
REDUCT
U3
A18 ASSEMBLY
FREQ REF
INPUT
J16
11
LOG A/D-
CONVERTER
U7,U8,U10,U11
LATCHES
U5,U6,U9,U19
FREQ RANG
GHz
S3
20V
ND
20V
11V

8410A



REFERENCE CHANNEL
VTO TUNING VOLTAGE
TEST CHANNEL
LOOP GAIN COMPENSATION Q20-Q34
DECODER U1, U2
SEARCH WINDOW SIZE Q6-Q19
SEARCH RATE REDUCTION U3
16
A7 ASSEMBLY
LOCK MODE SWITCH Q1-Q3
DC AMPLIFER Q4-Q6
SWP REF INPUT
J5
SWEEP STABILITY
A1R27
250 Hz
> 03V
SEARCHING
(SEE NOTE 2)
11
SEARCH INITIALIZE
A8 ASSEMBLY
LOCK MODE SENSOR Q1-Q2
SEARCH DISABLE
SEARCH SIGNAL GENERATOR Q3-Q7
250Hz
> 4V
SEARCHING
(SEE NOTE 2)
250Hz
6.5V
SEARCHING
11
PHASE ERROR DETECTOR B
CONVERT
LATCHES U5, U6, U9, U19
ENCODER AND MULTIPLEXER U1-U4
15
FREQ RANGE GHz
S3
FREQ RANGE GHz
DISABLE


A14 ASSEMBLY
20.278MHz 30-45mVp-p
20.278MHz IF AMPLIFIER Q3-Q7
SECOND MIXER Q1,Q2,CR1-CR4
AGC
20.278MHz
278kHz 190-250 mV PEAK-TROUGH
4
A16 ASSEMBLY
PHASE VERNIER
R2
278KHz AMPLIFER PHASE SHIFTER Q1-Q4
278MHz 19-30Vp-p
5
A15 ASSEMBLY
20.278MHz 200mVp-p
AGC AMPLIFIER Q1-Q7
AGC MONITOR Q8
7
REF CHANNEL LEVEL
M1
A13 ASSEMBLY
20MHz 1.8V
BUFFER Q1-Q2
2.78kHz
C7
20 MHz OSCILLATOR Q3-Q5
20MHz 1.8V
6
A12 ASSEMBLY
20.278MHz IF AMPLIFIER Q3-Q7
SECOND MIXER Q1,Q2,CR1,CR4
20.278MHz 25-45mVp-p
20.278MHz
190-250 mV PEAK-TROUGH
(INPUT -10 dBM TEST -30dBM REFERENCE)
278kHz
4
A11 ASSEMBLY
278kHz 90-250 p-p
278kHz AMPLIFIER Q3-Q7
278kHz >8Vp-p
8
AMPL VERNIE
R1
WEEP STABILITY
A1R27
250Hz M>03V SEARCHING (SEE NOTE 2)
11
ARCH INITIALIZE
11
CONVERT
SEARCH RATE REDUCTION
A9 ASSEMBLY
U1C
U1D
SWEEP DELAY U1A,U1B
UNLOCKED DETECTION Q1
HOLD ALLOW U3A
VTO LIMIT TRIGGER U4
A/D CONVERT U2B
SEARCH INITIALIZE
LOOP INITIALIZE U3B
EXTERNAL TRIGGER U2A
BREAK LOCK Q8, Q9
14

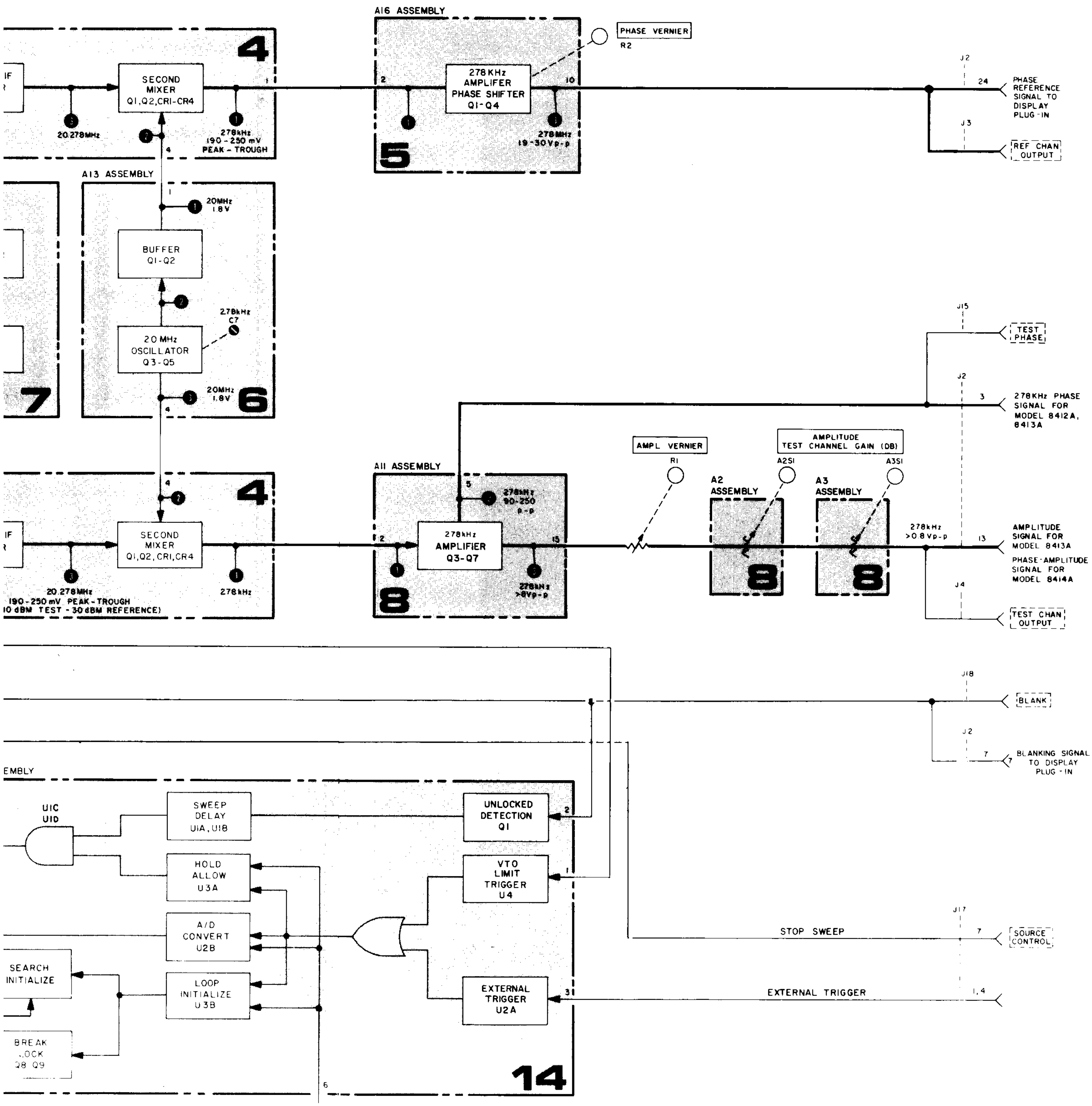


Figure 8-17. Detail Block Diagram

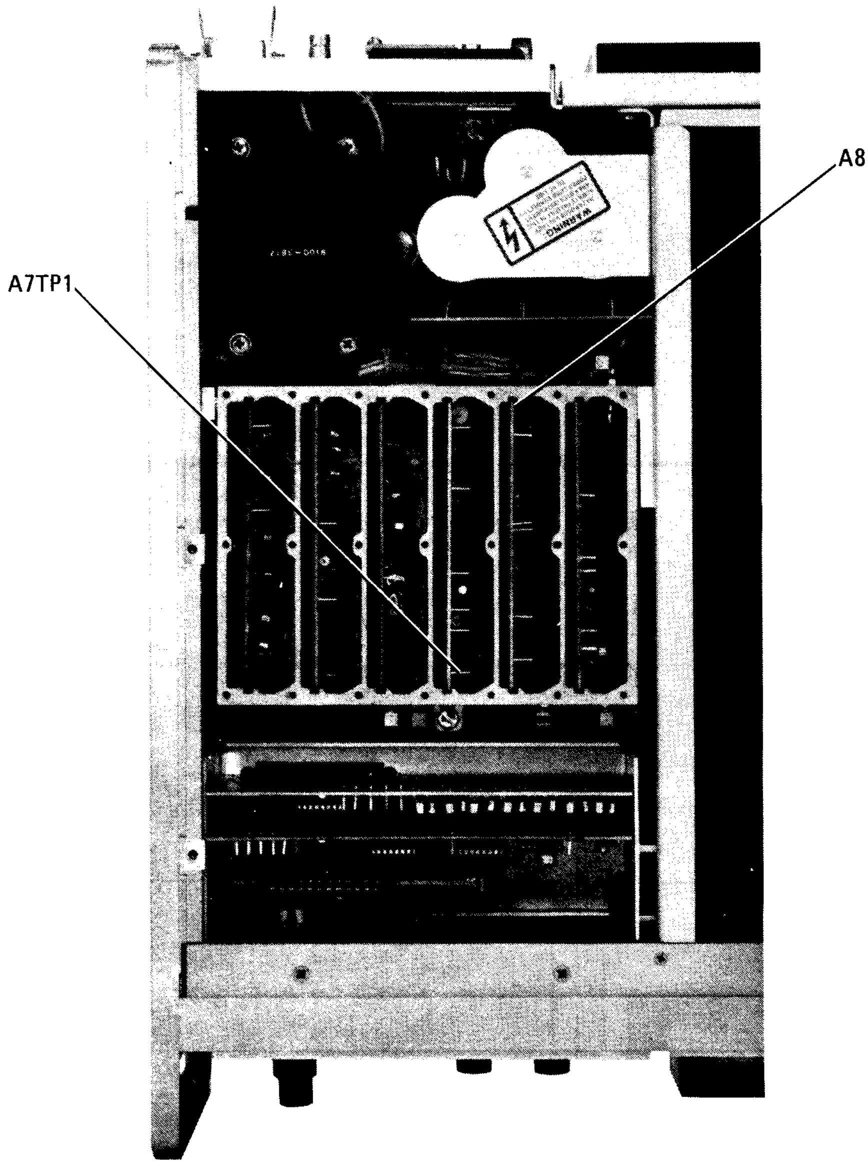
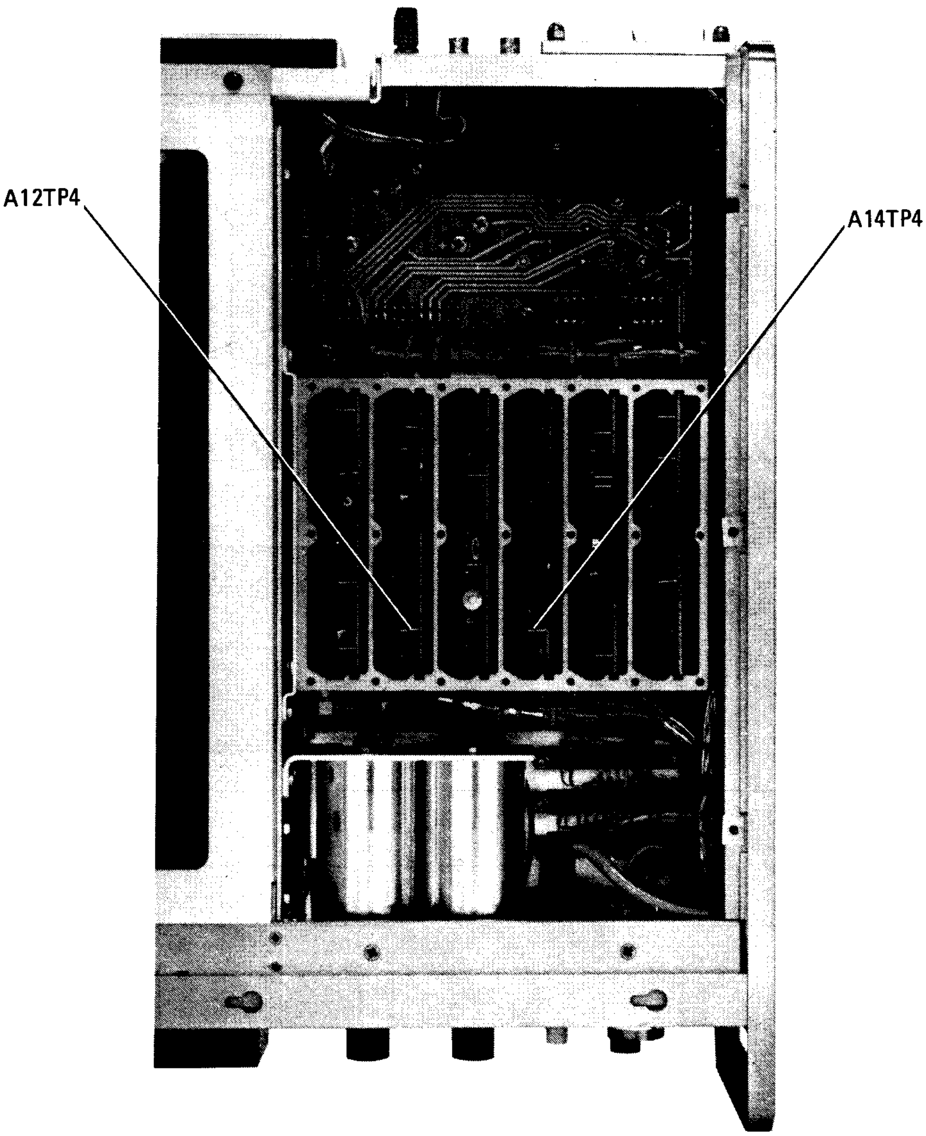
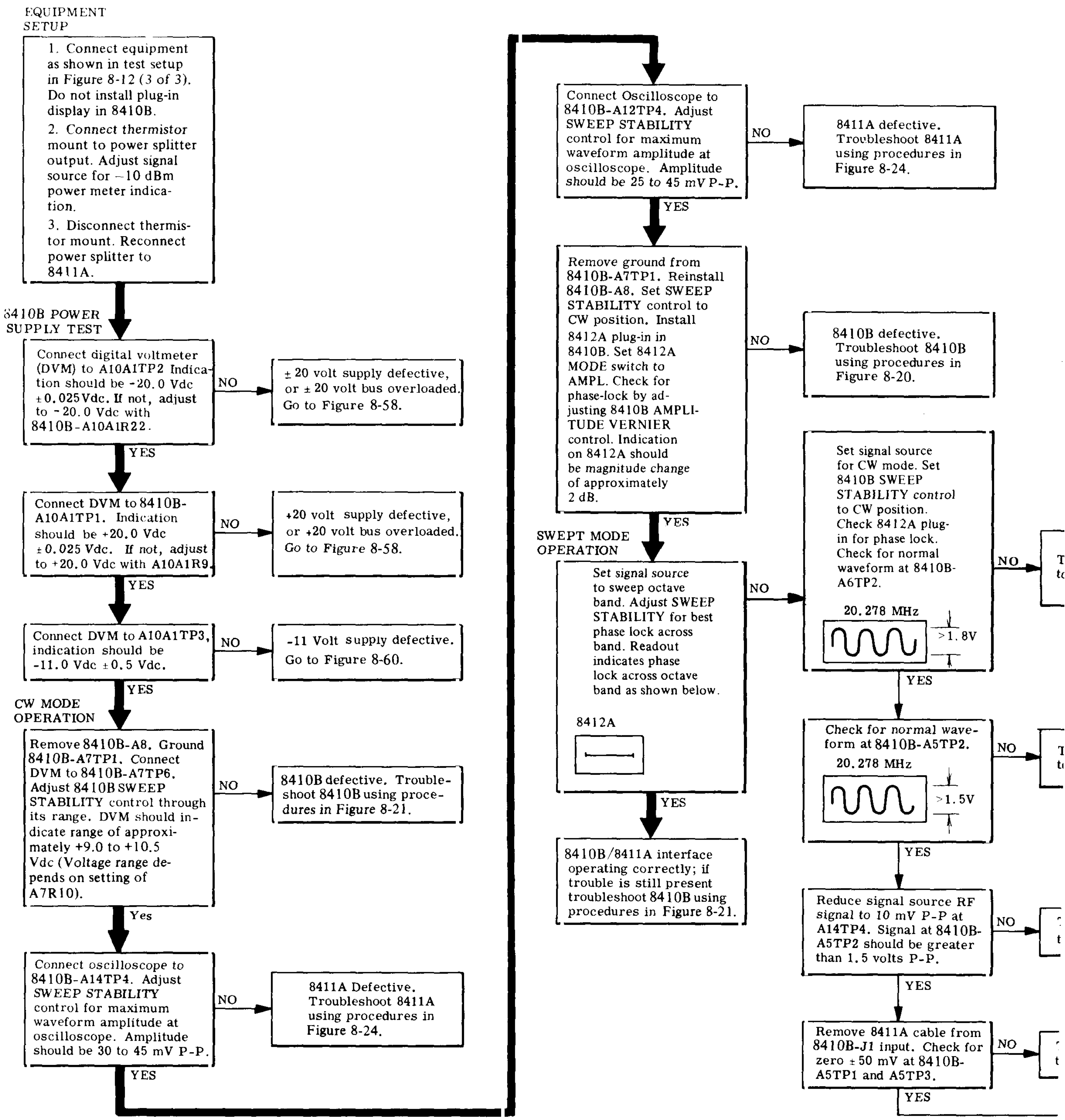


Figure 8-18. Models 8410B/8411A Interface Test Points (1 of 2)



BOTTOM VIEW

Figure 8-18. Models 8410B/8411A Interface Test Points (2 of 2)



EQUIPMENT SETUP
1. Connect equipment as shown in test setup in Figure 8-12 (3 of 3). Do not install plug-in display in 8410B.
2. Connect thermistor mount to power splitter output. Adjust signal source for −10 dBm power meter indication.
3. Disconnect thermistor mount. Reconnect power splitter to 8411A.
8410B POWER SUPPLY TEST
Connect digital voltmeter (DVM) to A10A1TP2 Indication should be -20.0 Vdc ±0.025Vdc. If not, adjust to -20.0 Vdc with 8410B-A10A1R22.
NO
± 20 volt supply defective, or ± 20 volt bus overloaded. Go to Figure 8-58.
YES
Connect DVM to 8410B-A10A1TP1. Indication should be +20.0 Vdc ±0.025 Vdc. If not, adjust to +20.0 Vdc with A10A1R9.
NO
+20 volt supply defective, or +20 volt bus overloaded. Go to Figure 8-58.
YES
Connect DVM to A10A1TP3, indication should be -11.0 Vdc ±0.5 Vdc.
NO
-11 Volt supply defective. Go to Figure 8-60.
YES
CW MODE OPERATION
Remove 8410B-A8. Ground 8410B-A7TP1. Connect DVM to 8410B-A7TP6. Adjust 8410B SWEEP STABILITY control through its range. DVM should indicate range of approximately +9.0 to +10.5 Vdc (Voltage range depends on setting of A7R10).
NO
8410B defective. Troubleshoot 8410B using procedures in Figure 8-21.
Yes
Connect oscilloscope to 8410B-A14TP4. Adjust SWEEP STABILITY control for maximum waveform amplitude at oscilloscope. Amplitude should be 30 to 45 mV P-P.
NO
8411A Defective. Troubleshoot 8411A using procedures in Figure 8-24.
YES
Connect Oscilloscope to 8410B-A12TP4. Adjust SWEEP STABILITY control for maximum waveform amplitude at oscilloscope. Amplitude should be 25 to 45 mV P-P.
NO
8411A defective. Troubleshoot 8411A using procedures in Figure 8-24.
YES
Remove ground from 8410B-A7TP1. Reinstall 8410B-A8. Set SWEEP STABILITY control to CW position. Install 8412A plug-in in 8410B. Set 8412A MODE switch to AMPL. Check for phase-lock by adjusting 8410B AMPLITUDE VERNIER control. Indication on 8412A should be magnitude change of approximately 2 dB.
NO
8410B defective. Troubleshoot 8410B using procedures in Figure 8-20.
YES
SWEPT MODE OPERATION
Set signal source to sweep octave band. Adjust SWEEP STABILITY for best phase lock across band. Readout indicates phase lock across octave band as shown below.
8412A
NO
Set signal source for CW mode. Set 8410B SWEEP STABILITY control to CW position. Check 8412A plug-in for phase lock. Check for normal waveform at 8410B-A6TP2.
20.278 MHz
>1.8V
NO
YES
8410B/8411A interface operating correctly; if trouble is still present troubleshoot 8410B using procedures in Figure 8-21.
YES
Check for normal waveform at 8410B-A5TP2.
20.278 MHz
>1.5V
NO
YES
Reduce signal source RF signal to 10 mV P-P at A14TP4. Signal at 8410B-A5TP2 should be greater than 1.5 volts P-P.
NO
YES
Remove 8411A cable from 8410B-J1 input. Check for zero ±50 mV at 8410B-A5TP1 and A5TP3.
NO
YES

Figure 8

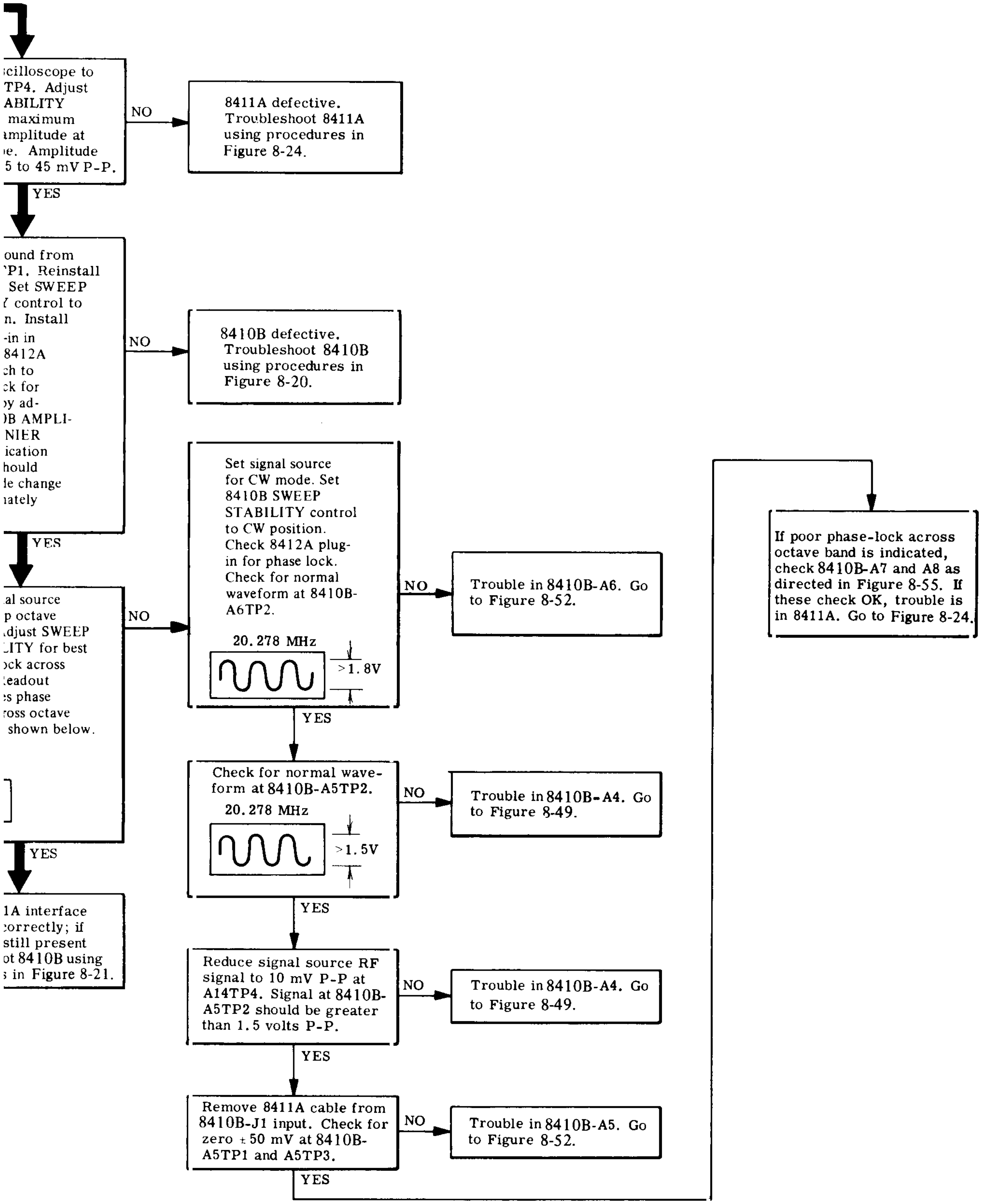


Figure 8-19. Model 8410B/8411A Interface Troubleshooting

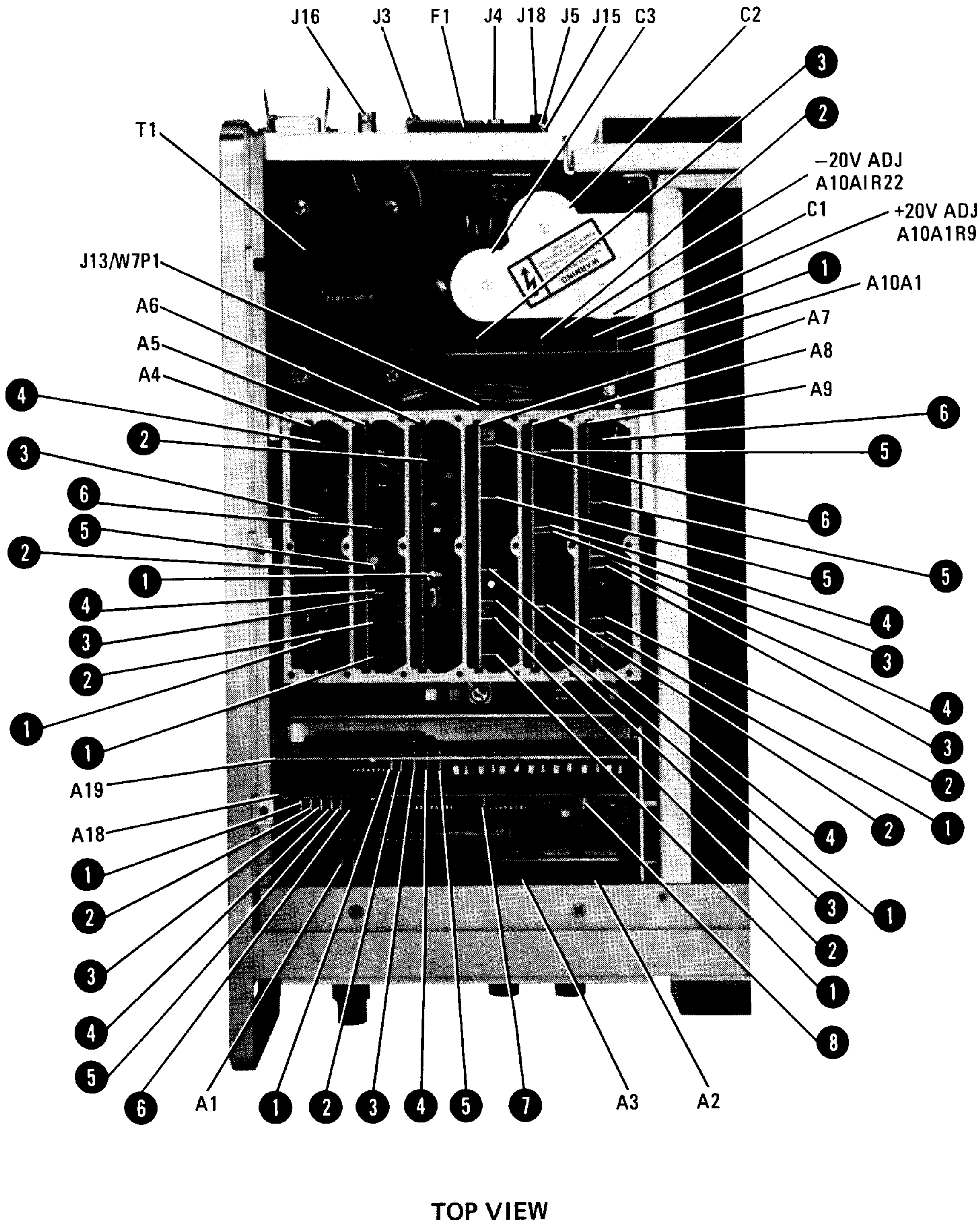


Figure 8-20. Model 8410B Test Points (1 of 2)

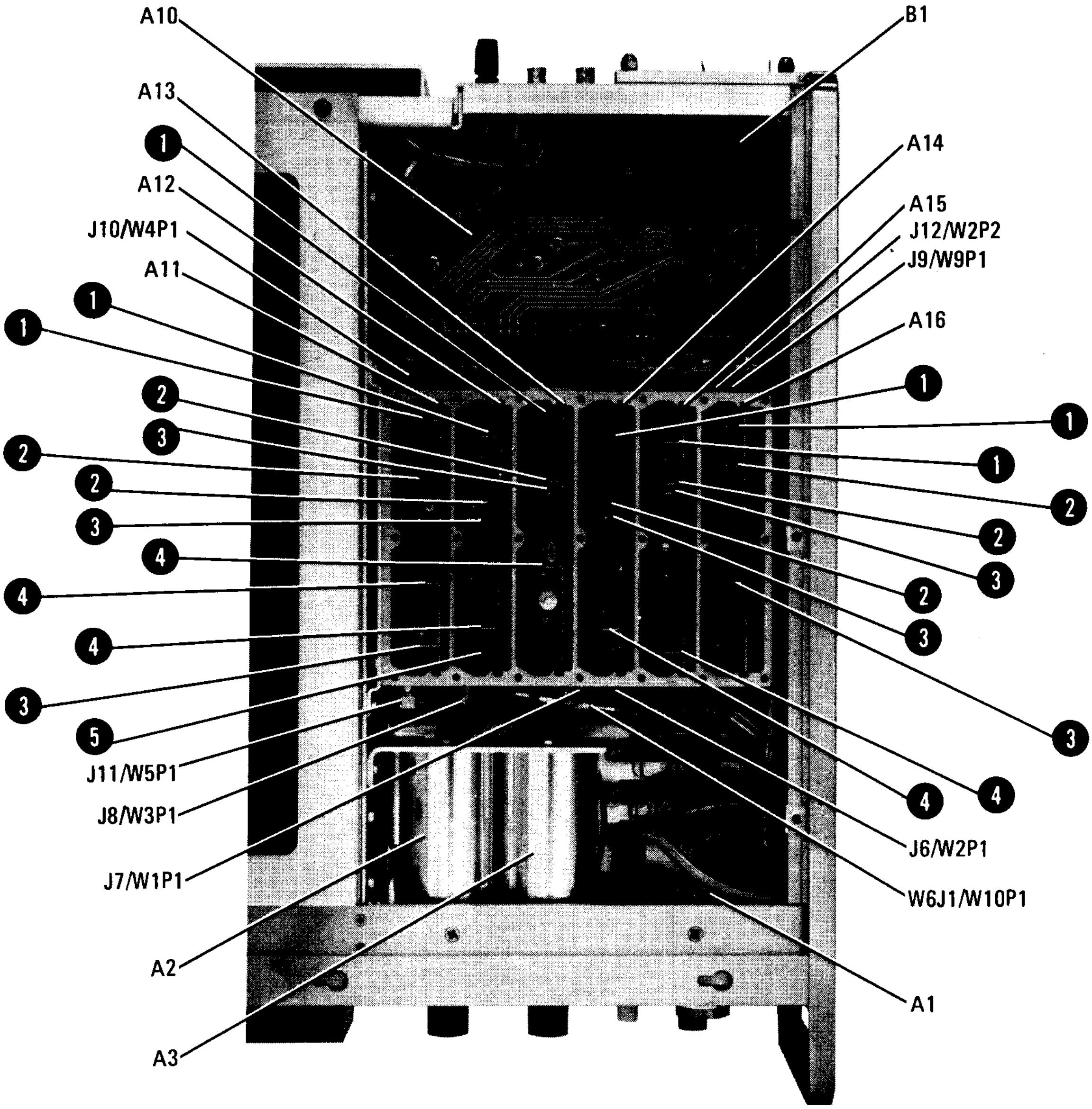
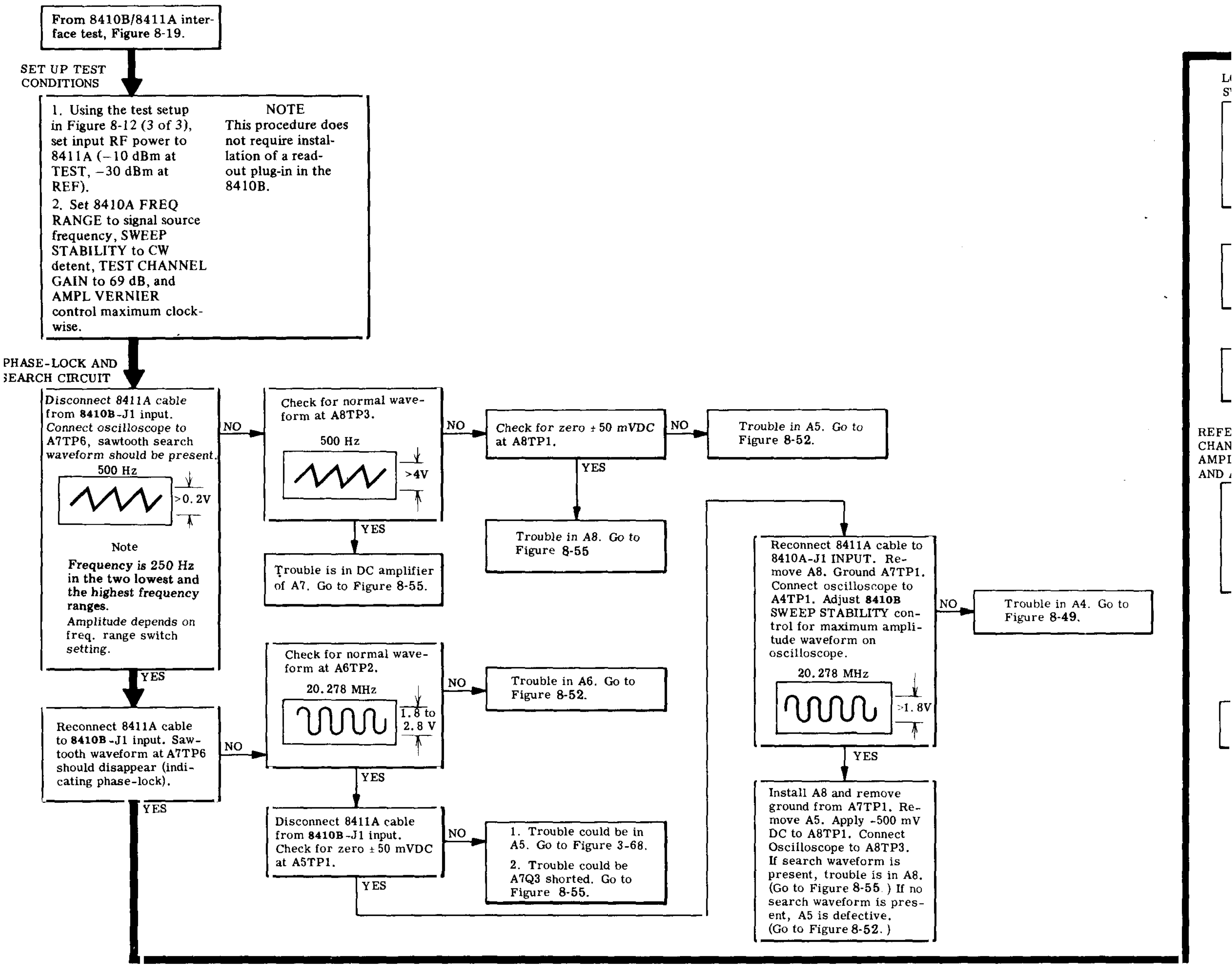
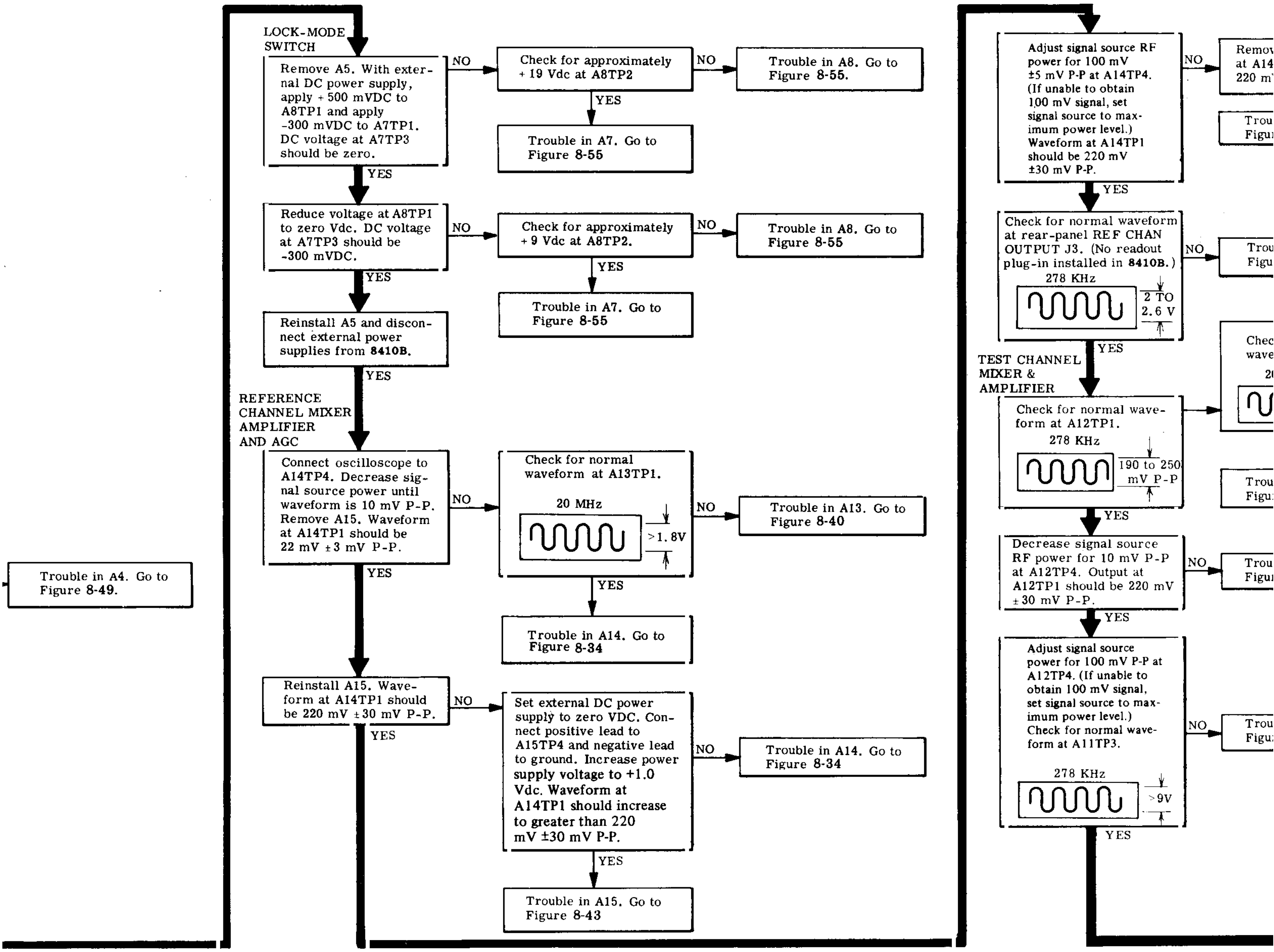


Figure 8-20. Model 8410B Test Points (2 of 2)



From 8410B/8411A interface test, Figure 8-19.
SET UP TEST CONDITIONS
1. Using the test setup in Figure 8-12 (3 of 3), set input RF power to 8411A (−10 dBm at TEST, −30 dBm at REF).
2. Set 8410A FREQ RANGE to signal source frequency, SWEEP STABILITY to CW detent, TEST CHANNEL GAIN to 69 dB, and AMPL VERNIER control maximum clockwise.
NOTE
This procedure does not require installation of a read-out plug-in in the 8410B.
PHASE-LOCK AND SEARCH CIRCUIT
Disconnect 8411A cable from 8410B-J1 input. Connect oscilloscope to A7TP6, sawtooth search waveform should be present.
500 Hz
>0.2V
Note
Frequency is 250 Hz in the two lowest and the highest frequency ranges.
Amplitude depends on freq. range switch setting.
NO
Check for normal waveform at A8TP3.
500 Hz
>4V
NO
Check for zero ± 50 mVDC at A8TP1.
NO
Trouble in A5. Go to Figure 8-52.
YES
Trouble in A8. Go to Figure 8-55
YES
Trouble is in DC amplifier of A7. Go to Figure 8-55.
YES
Reconnect 8411A cable to 8410B-J1 input. Sawtooth waveform at A7TP6 should disappear (indicating phase-lock).
NO
Check for normal waveform at A6TP2.
20.278 MHz
1.8 to 2.8 V
NO
Trouble in A6. Go to Figure 8-52.
YES
Disconnect 8411A cable from 8410B-J1 input. Check for zero ± 50 mVDC at A5TP1.
NO
1. Trouble could be in A5. Go to Figure 3-68.
2. Trouble could be A7Q3 shorted. Go to Figure 8-55.
YES
Reconnect 8411A cable to 8410A-J1 INPUT. Remove A8. Ground A7TP1. Connect oscilloscope to A4TP1. Adjust 8410B SWEEP STABILITY control for maximum amplitude waveform on oscilloscope.
20.278 MHz
>1.8V
NO
Trouble in A4. Go to Figure 8-49.
YES
Install A8 and remove ground from A7TP1. Remove A5. Apply -500 mV DC to A8TP1. Connect Oscilloscope to A8TP3. If search waveform is present, trouble is in A8. (Go to Figure 8-55.) If no search waveform is present, A5 is defective. (Go to Figure 8-52.)
YES
REFE
CHAN
AMPI
AND



LOCK-MODE SWITCH
Remove A5. With external DC power supply, apply + 500 mVDC to A8TP1 and apply -300 mVDC to A7TP1. DC voltage at A7TP3 should be zero.
NO
Check for approximately + 19 Vdc at A8TP2
NO
Trouble in A8. Go to Figure 8-55.
YES
Trouble in A7. Go to Figure 8-55
YES
Reduce voltage at A8TP1 to zero Vdc. DC voltage at A7TP3 should be -300 mVDC.
NO
Check for approximately + 9 Vdc at A8TP2.
NO
Trouble in A8. Go to Figure 8-55
YES
Trouble in A7. Go to Figure 8-55
YES
Reinstall A5 and disconnect external power supplies from 8410B.
YES
REFERENCE CHANNEL MIXER AMPLIFIER AND AGC
Connect oscilloscope to A14TP4. Decrease signal source power until waveform is 10 mV P-P. Remove A15. Waveform at A14TP1 should be 22 mV ±3 mV P-P.
NO
Check for normal waveform at A13TP1.
20 MHz
>1.8V
NO
Trouble in A13. Go to Figure 8-40
YES
Trouble in A14. Go to Figure 8-34
YES
Trouble in A4. Go to Figure 8-49.
Reinstall A15. Waveform at A14TP1 should be 220 mV ±30 mV P-P.
NO
Set external DC power supply to zero VDC. Connect positive lead to A15TP4 and negative lead to ground. Increase power supply voltage to +1.0 Vdc. Waveform at A14TP1 should increase to greater than 220 mV ±30 mV P-P.
NO
Trouble in A14. Go to Figure 8-34
YES
Trouble in A15. Go to Figure 8-43
YES
Adjust signal source RF power for 100 mV ±5 mV P-P at A14TP4. (If unable to obtain 100 mV signal, set signal source to maximum power level.) Waveform at A14TP1 should be 220 mV ±30 mV P-P.
NO
YES
Check for normal waveform at rear-panel REF CHAN OUTPUT J3. (No readout plug-in installed in 8410B.)
278 KHz
2 TO 2.6 V
NO
YES
TEST CHANNEL MIXER & AMPLIFIER
Check for normal waveform at A12TP1.
278 KHz
190 to 250 mV P-P
YES
Decrease signal source RF power for 10 mV P-P at A12TP4. Output at A12TP1 should be 220 mV ± 30 mV P-P.
NO
YES
Adjust signal source power for 100 mV P-P at A12TP4. (If unable to obtain 100 mV signal, set signal source to maximum power level.) Check for normal waveform at A11TP3.
278 KHz
>9V
NO
YES

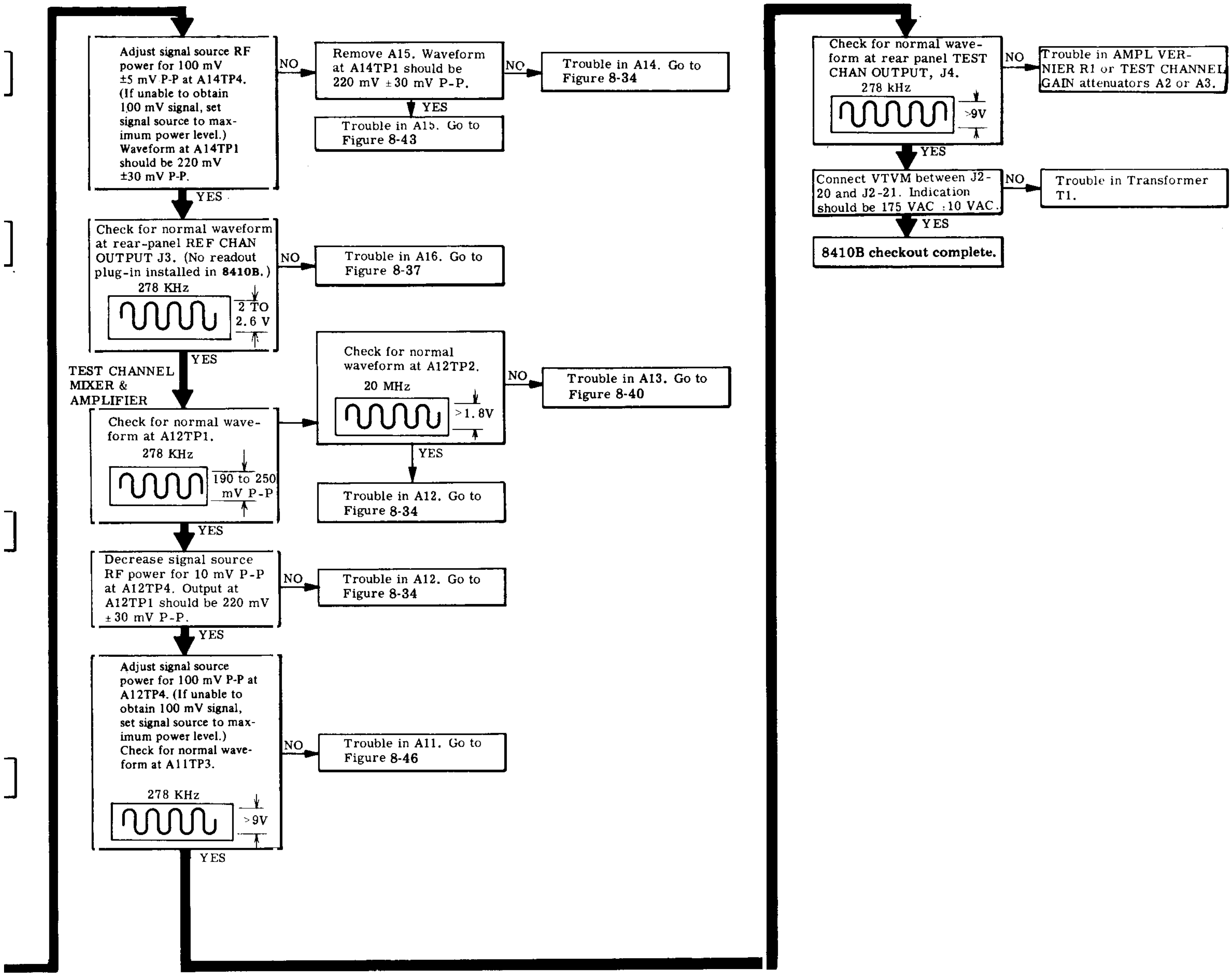


Figure 8-21. Model 8410B Troubleshooting

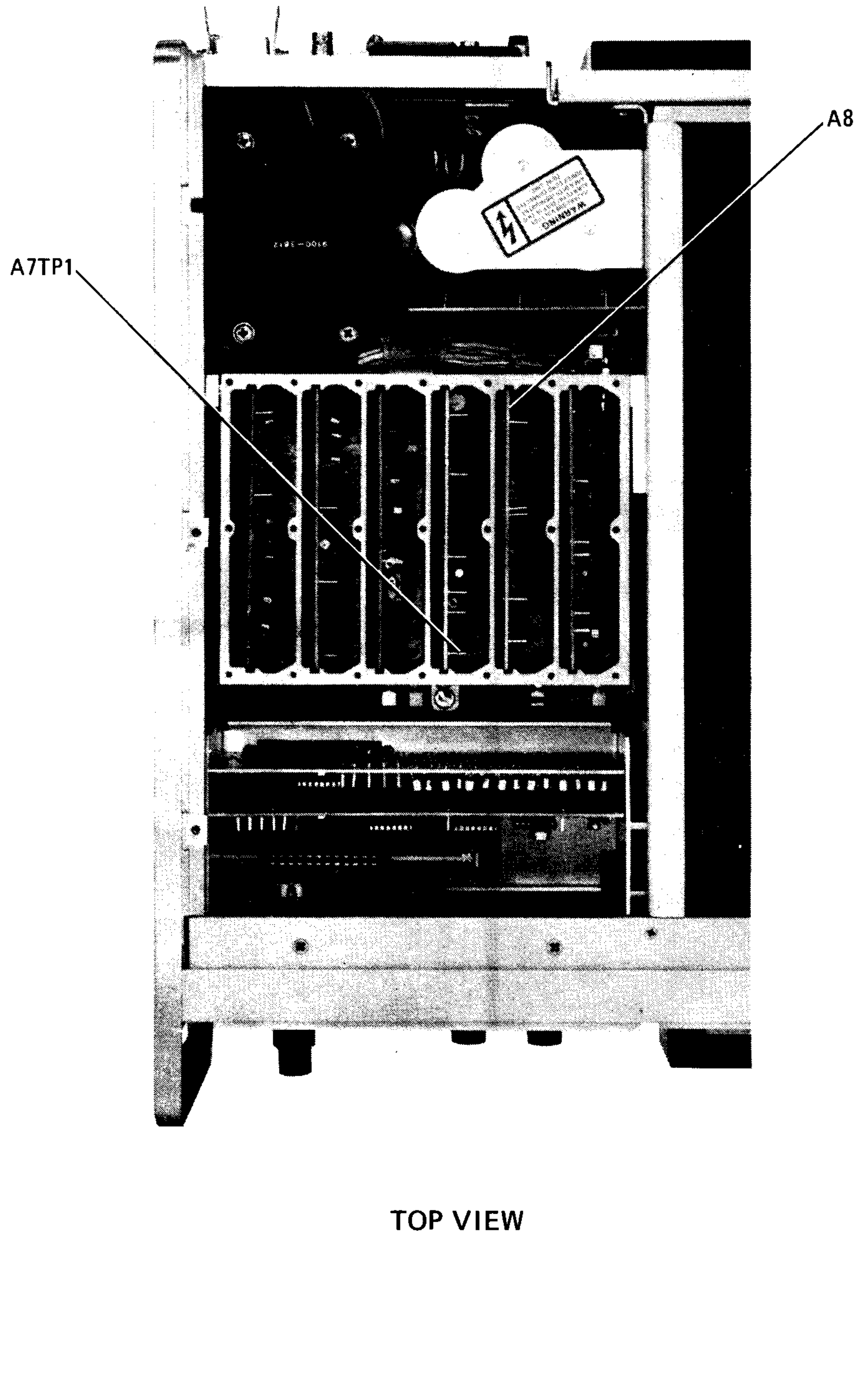


Figure 8-22. Test Points for 8411A Troubleshooting (1 of 2)
(Shows 8410B TP's)

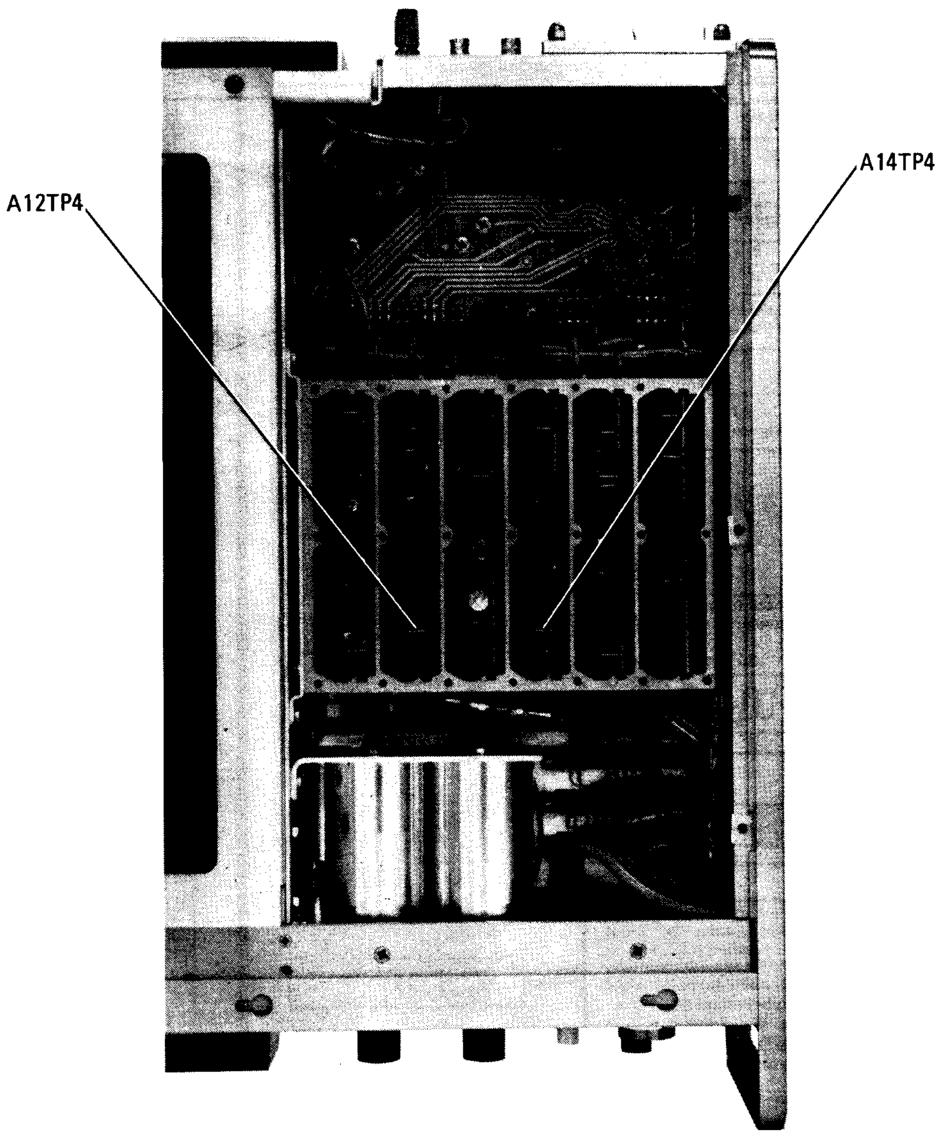


Figure 8-22. Test Points for 8411A Troubleshooting (2 of 2)
(Shows 8410B TP's)

From 8410B/8411A interface test, Figure 8-19.

CW MODE

Using the test setup in Figure 8-12 (3 of 3), check CW input RF power to 8411A (−10 dBm at TEST and −30 dBm at REF).

Set 8410B FREQ RANGE to signal source freq., and TEST CHANNEL GAIN to 69 dB.

Remove 8410B-A8. Ground A7TP1. Connect the two vertical inputs of dual trace Oscilloscope to A12TP4 and A14TP4. Adjust SWEEP STABILITY control for maximum amplitude on oscilloscope. Both waveforms should be 25 to 45 mV P-P.

NO →

1. If both waveforms are incorrect, trouble probably is step generator or drive to the step generator. Go to Figure 8-24.

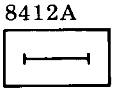
2. If only one waveform is incorrect, trouble probably is in stripline, sampler, or preamplifier in affected channel. Go to Figure 8-28 and check preamplifier. If preamplifier checks correctly, go to Figure 8-24 and check sampler and stripline.

YES ↓

SWEPT MODE

Reinstall 8410B-A8 and remove ground from 8410B-A7TP1. Install 8412A in 8410B. (Set 8412A MODE switch to AMPL. Set signal source to sweep octave band. Adjust 8410B SWEEP STABILITY control for best phase-lock across band. Readout indicates phase-lock over entire band, and smooth trace as shown.

8412A



NO →

IDENTIFY TROUBLE FROM ONE OF THE FOLLOWING WAVEFORMS:

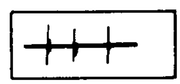
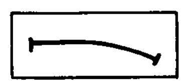
8412A	TROUBLE AND CORRECTIVE PROCEDURE
	Phase-lock loop gain too low. Go to 8411A-A6 shaping amplifier adjustment, Paragraph 5-21.
	Phase-lock loop gain too high. Go to 8411A-A6 shaping amplifier adjustment, Paragraph 5-21.
	Insufficient frequency response at high or low frequency. 1. If the amplitude of the trace changes on the low-frequency end when the SWEEP STABILITY control is adjusted, trouble is incorrect drive pulse from the stripline to the sampler. Go to Figure 8-24 and troubleshoot stripline, step generator, power amplifier and VTO. 2. If SWEEP STABILITY control does not affect waveform, trouble is in one of the samplers. Check sampler, Figure 8-24.

Figure 8-23. Model

8411A POWER AMP A3, STRIPLINE, AND SAMPLERS A1 AND A2

NOTE

Because of the frequencies present, complete trouble isolation in the power amplifier, stripline, samplers, and VTO circuits is not possible without the aid of a spectrum analyzer. If a spectrum analyzer is not available, some trouble isolation can be done with common test equipment. (See Figure 8-25).

Connect equipment and setup test conditions described in Figure 8-12. Remove 8410B-A8 circuit board and connect ground jumper to 8410B-A7TP1. Connect dual-trace oscilloscope to A12TP4 and A14TP4 and adjust 8410B SWEEP STABILITY control for maximum amplitude on oscilloscope. Waveforms should be normal.

1. If waveform is not present at both A12TP4 and A14TP4, trouble is probably in the common stripline, step generator, power amplifier, or VTO.

2. If only one of the waveforms is missing or is not correct, trouble is probably in the associated stripline, sampler, or preamplifier circuit for the channel. Go to Figure 8-28 and check preamplifier, then proceed.

ONE WAVE-FORM BAD

BOTH WAVE-FORMS BAD

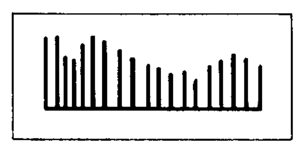
A. STEP GENERATOR

1. Check waveform at Stripline TP1, using spectrum analyzer and 10:1 oscilloscope probe. (See display A.) If waveform is correct or missing, check power amplifier A3. If step generator circuit is not operating, waveform will be similar to display B. If trouble is in solder connection between power amplifier and stripline, probe contact may cause circuit to operate. Resolder connection.

2. Check resistance from stripline assembly TP1 to ground. Resistance should be 20 ohms. If resistance is approximately 8 ohms, stripline capacitor C1 is probably shorted. If resistance is infinite, tighten nylon screw shown in Figure 6-4, item 2.

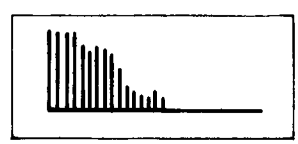
3. If unable to obtain correct waveform, and resistance from TP1 to ground is 20 ohms, replace step generator CR1.

DISPLAY A. STRIPLINE TP1, STEP GENERATOR OPERATING NORMALLY



Normal frequency spectrum shows high-order harmonics present.

DISPLAY B, STRIPLINE TP1, STEP GENERATOR NOT OPERATING



Frequency spectrum of abnormal pulse lacks high order harmonics.

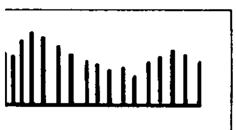
CO
WA
OR
FO
STR

ƆR

n at Stripline TP1, using spectrum
cilloscope probe. (See display A.)
:t or missing, check power ampli-
ator circuit is not operating, wave-
o display B. If trouble is in solder
power amplifier and stripline,
ause circuit to operate. Resolder

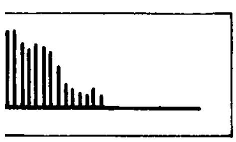
e from stripline assembly TP1 to
ould be 20 ohms. If resistance is
s, stripline capacitor C1 is probably
is infinite, tighten nylon screw
em 2.
ain correct waveform, and resis-
ound is 20 ohms, replace step

A. STRIPLINE TP1, STEP
R OPERATING NORMALLY



al frequency spectrum
high-order harmonics
nt.

B, STRIPLINE TP1, STEP
TOR NOT OPERATING



quency spectrum of
rmal pulse lacks high
r harmonics.

CORRECT WAVEFORM OR NO WAVE-FORM AT STRIPLINE TP1

B. POWER AMPLIFIER A3

1. Check waveform at A3TP9, using sampling oscilloscope with 100:1 probe and blocking capacitor, or spectrum analyzer and 10:1 probe. (SEE DISPLAY.) If waveform is incorrect, troubleshoot VTO assembly A7 with procedure of Figure 8-31.

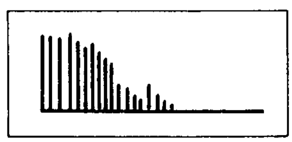
2. Check waveform at A3TP7. (See Display.) If waveform is incorrect, troubleshoot A3Q1 circuit.

3. Check dc voltage at A3TP7. If voltage is incorrect, adjust A6R14 to obtain correct voltage. If adjustment of **A6R14 is necessary, alignment procedure in Paragraph 5-20 must be performed after troubleshooting the circuit.** circuit.

4. Check dc voltage at A3TP3 and A3TP6. If dc voltage is not ±10% of the correct value, troubleshoot associated circuit.

5. Check dc voltage at A3TP1, A3TP2, A3TP4 and A3TP5. If dc voltage is not ±10% of the correct value, troubleshoot associated circuit.

8411A-A3TP7 AND A3TP9



C. STRIPLINE

Before tro
trouble by
cover and

Do not mov
probing str

Remove mixer
malfunctioning
TP2 or TP3. (S

a. If wavefor
or the pre
step D.

b. If wavefor
sampler.
the same
line. Chec

STR
GENE

F
hi

ɔscillo-
spectrum
eform is
cedure

wave-

rrect,
ent of
raph
circuit.

voltage
ciated

d A3TP5.
leshoot

C. STRIPLINE

NOTE

Before troubleshooting stripline, try to clear trouble by tightening all screws on stripline top cover and on the two mixer coax clamps.

CAUTION

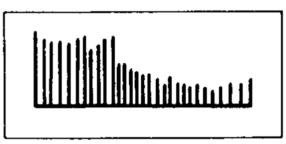
Do not move mixer coax center conductor when probing stripline or conductor may break.

Remove mixer coax clamp (Figure 6-5, Item 6) on malfunctioning channel and check waveform at stripline TP2 or TP3. (See display)

a. **If waveform is correct, trouble is in either the sampler or the preamplifier of defective channel. Proceed to step D.**

b. If waveform is incorrect, trouble is in stripline or sampler. A short in the sampler drive coax may give the same indication as a short at the end of the stripline. Check sampler drive coax, step D-6.

STRIPLINE TP2 AND TP3 STEP GENERATOR OPERATING NORMALLY

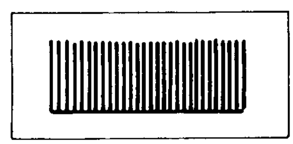


Frequency spectrum shows high-order harmonics present.

CORRECT WAVEFORM AT STRIPLINE TP2 AND TP3

D. SAMPLER A1 AND A2
1. Check for open RF input conne
from APC-7 inner conductor to outer
not, replace sampler.
2. Remove input signal and connec
to 8411A APC-7 RF input connector.
biasing or defective diodes, the drive s
cancel in the sampler cavity and a sign
The signal amplitude will depend upo
A and B.)
3. Adjust A4R3 or A5R3, as appro
(Display A). If a maximum is obtaine
in A4 or A5 are working normally. Pr
obtained, trouble is either shorted or
supply in A4 or A5. Proceed to Step 4
4. Check bias supply with dc voltm
appropriate, to midposition, and set A
wise. Remove both clip-on leads from
of each lead. If the voltages are appro
in polarity, the bias network is operat
Replace sampler.
5. To check for open drive coax, m
TP3 to ground. Be sure center conduc
with stripline when taking resistance r
zero ohms. If resistance is about 40 o
sampler.
6. To check for shorted drive coax
sampler diodes. Connect spectrum an
one at a time. Normal indication is a l
suspected sampler is much lower in ar
coax is probably shorted. The short c
plane of the stripline. Gently move th
its position in the hole through the st
remove the short, remove the end-sec
line and drive coax visually. Reinstall
for short. If the indication is still the s
sampler.

DISPLAY A. 8411A APC-7 RF INPUT CONNECTOR SAMPLING DIODE CONDUCTION BALANCED.



Tops of all harmonics close to same amplitude when A4R3 or A5R3 adjusted correctly.

Figure 8-24. 8411A-A

:

pline, try to clear
rews on stripline top
coax clamps.

N

iter conductor when
or may break.

ıre 6-5, Item 6) on
k waveform at stripline

ouble is in either the sampler
ctive channel. Proceed to

rouble is in stripline or
mpler drive coax may give
iort at the end of the strip-
coax, step D-6.

D TP3 STEP
ING NORMALLY



ım shows
ıics present.

CORRECT
WAVEFORM
AT STRIPLINE
TP2 AND TP3

D. SAMPLER A1 AND A2

1. Check for open RF input connector or 50 ohm load as follows. Resistance from APC-7 inner conductor to outer conductor should be 50 ohms ±5 ohms. If not, replace sampler.

2. Remove input signal and connect spectrum analyzer (with no divider probe) to 8411A APC-7 RF input connector. If any unbalance exists due to abnormal biasing or defective diodes, the drive signals from the step generator will not cancel in the sampler cavity and a signal will be present at the input connector. The signal amplitude will depend upon the amount of unbalance. (See display A and B.)

3. Adjust A4R3 or A5R3, as appropriate, for harmonics at same amplitude (Display A). If a maximum is obtained, the sampler diodes and the bias supply in A4 or A5 are working normally. Proceed to Step 5. If a maximum cannot be obtained, trouble is either shorted or open sampler diodes, or defective bias supply in A4 or A5. Proceed to Step 4.

4. Check bias supply with dc voltmeter as follows. Set A4R3 or A5R3, as appropriate, to midposition, and set A4R5 or A5R5 maximum counterclockwise. Remove both clip-on leads from the sampler. Measure dc voltage at end of each lead. If the voltages are approximately equal in magnitude and opposite in polarity, the bias network is operating properly, and the sampler is faulty. Replace sampler.

5. To check for open drive coax, measure resistance from Stripline TP2 or TP3 to ground. Be sure center conductor of drive coax is making contact with stripline when taking resistance measurement. Resistance should be zero ohms. If resistance is about 40 ohms, the drive coax is open. Replace sampler.

6. To check for shorted drive coax, disconnect all four clip-on leads to sampler diodes. Connect spectrum analyzer to the APC-7 RF input connectors one at a time. Normal indication is a low amplitude signal. If the signal at the suspected sampler is much lower in amplitude than the other signal, the drive coax is probably shorted. The short could be inside the sampler or at the ground plane of the stripline. Gently move the drive coax center conductor to relocate its position in the hole through the stripline. If moving the drive coax does not remove the short, remove the end-section of stripline and examine the stripline and drive coax visually. Reinstall the end-section of stripline and recheck for short. If the indication is still the same (short still present), replace the sampler.

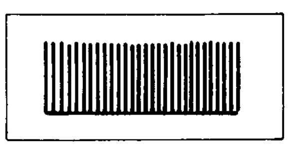
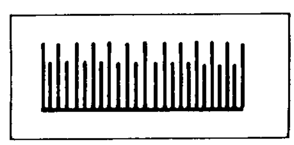
DISPLAY A. 8411A APC-7 RF INPUT CONNECTOR SAMPLING DIODE CONDUCTION BALANCED.	DISPLAY B. 8411A APC-7 RF INPUT CONNECTOR SAMPLING DIODE CONDUCTION UNBALANCED.
 Tops of all harmonics close to same amplitude when A4R3 or A5R3 adjusted correctly.	 A4R3 or A5R3 not adjusted correctly or sampler diode shorted or open. Odd-number harmonics high in amplitude and even-number harmonics low in amplitude. All should be the same.

Figure 8-24. 8411A-A1, A2, A3, and Stripline Troubleshooting

8411A STRIPLINE, SAMPLERS A1 AND A2, AND POWER AMPLIFIER A3, CIRCUIT DESCRIPTION

STRIPLINE AND SAMPLERS

Sampler diodes A1CR1, A1CR2, A2CR1, and A2CR2 are reverse-biased by a dc voltage from preamplifiers A4 and A5. A harmonic-rich local oscillator signal from step generator CR1 is applied to the diode mixers in the sampler. Harmonics of the local oscillator mix with the RF input signal, producing an IF signal at A4 and A5. When the system is phase-locked, a harmonic of the local oscillator (VTO) is 20.278 MHz above the RF input signal, giving a difference IF of 20.278 MHz.

POWER AMPLIFIER

The local oscillator signal from the VTO (62 to 154 MHz) is applied to power amplifier A3Q1—A3Q7. This high amplitude signal from the power amplifier is applied across step generator CR1. During the positive-going half cycle of the signal, step-recovery diode CR1 conducts. As the signal starts in the negative direction, CR1 continues to conduct because of the stored charge in the diode. When the stored charge is depleted, conduction through the diode abruptly ceases, producing a fast-rise-time pulse at C1. This pulse, rich in harmonic content, is applied to the sampling diodes in A1 and A2.

DRIVER

The base bias of A3Q1 is adjusted by BIAS ADJUST potentiometer A6R14. This adjustment sets the dc voltage at A3Q1 collector, which forward-biases the bases of A3Q2 and A3Q5. Forward bias at A3Q2 and A3Q5 determines the operating point and, thus, the gain of the amplifiers. This controls the peak-to-peak amplitude of the signal applied to the step generator and thus, controls the amplitude of the signal applied to samplers A1 and A2.

IOTE

not available, use this pro-
equipment. This procedure
ı of all circuits.

IOTE

output is incorrect, check
defective channel first as
8, before performing this

ı stripline TP1 to ground. Re-
If resistance is approximately
C1 is probably shorted. If re-
ıylon screw shown in Figure

connection between power am-
contact may cause circuit to
ʒ correct indication. Resolder

TP7. If incorrect, adjust
age.

)TE

rform adjustment procedure

3TP3 and A3TP6. If dc voltage
alue troubleshoot associated

3TP1, A3TP2, A3TP4, and
±10% of the correct value,
uit.

le by tightening all screws on
the two mixer coax clamps.

D. SAMPLERS A1 AND A2

1. With power off, check for open circuit at RF input connector or 50-ohm load. Resistance from APC-7 connector inner conductor to outer conductor should be 50 ohms ± 5 ohms. If not, replace sampler.

2. Connect 8411A to 8410B and apply power. Adjust R3 (BIAS CENTERING ADJUST) to approximately mid-position.

3. Adjust R5 (BIAS ADJUST) fully counterclockwise to bias off sampler.

4. Remove both clip-on leads from the sampler. Measure dc voltage at the end of each lead. If the voltages are approximately equal in magnitude and opposite in polarity, the bias network is operating properly.

5. To check for a shorted sampler diode, attach dc voltmeter probe to the end of the clip-on lead, note the magnitude of voltage and make contact with the sampler terminal. If the voltage decreases more than 10%, diode is shorted. Replace sampler.

6. To check for open diode, connect both clip-on leads to sampler. Turn R5 fully clockwise. Connect oscilloscope to either A12TP4 or A14TP4 (whichever channel is being tested). Disconnect one sampler clip-on lead at a time. If the good diode is disconnected and the other diode is open, no signal will be present on the oscilloscope. If the other diode is good, the oscilloscope amplitude will be at least 50% of the original amplitude with both leads connected.

CAUTION

Do not move mixer coax center conductor when connecting probe to stripline. Conductor may break.

7. Turn off power. Measure resistance from stripline TP2 or TP3 to ground. Be sure center conductor of drive coax is making contact with stripline when taking resistance measurements. Resistance should be zero. If resistance is 40 ohms, the drive coax is open. Replace sampler.

Figure 8-25. 8411A-A1, A2, A3 and Stripline Troubleshooting Using Common Test Equipment

8411A POWER AMPLIFIER A3, STRIPLINE, AND SAMPLERS A1 AND A2
ALTERNATE PROCEDURE USING COMMON TEST EQUIPMENT

NOTE

If a spectrum analyzer is not available, use this procedure and standard test equipment. This procedure does not check operation of all circuits.

NOTE

If only one preamplifier output is incorrect, check the preamplifier in the defective channel first as instructed in Figure 8-28, before performing this procedure.

A. STEP GENERATOR

1. Check resistance from stripline TP1 to ground. Resistance should be 20 ohms. If resistance is approximately 8 ohms, stripline capacitor C1 is probably shorted. If resistance is infinite, tighten nylon screw shown in Figure 6-5 , Item 2.

2. If trouble is in solder connection between power amplifier and stripline, probe contact may cause circuit to momentarily connect, giving correct indication. Resolder connection.

B. POWER AMPLIFIER A3

1. Check dc voltage at A3TP7. If incorrect, adjust A6R14 to obtain correct voltage.

NOTE

If A6R14 is adjusted, perform adjustment procedure in Paragraph 5-20.

2. Check dc voltage at A3TP3 and A3TP6. If dc voltage is not ±10% of the correct value troubleshoot associated circuit.

3. Check dc voltage at A3TP1, A3TP2, A3TP4, and A3TP5. If dc voltage is not ±10% of the correct value, troubleshoot associated circuit.

C. STRIPLINE

1. Try to correct trouble by tightening all screws on stripline top cover and on the two mixer coax clamps.

D. SAMPLERS A1 AN

1. With power off, c
connector or 50-ohm lo
connector inner conduc
50 ohms ± 5 ohms. If n

2. Connect 8411A to
R3 (BIAS CENTERING
position.

3. Adjust R5 (BIAS A
bias off sampler.

4. Remove both clip-
ure dc voltage at the en
approximately equal in
the bias network is ope

5. To check for a sh
voltmeter probe to the
magnitude of voltage an
terminal. If the voltage
is shorted. Replace sar

6. To check for open
to sampler. Turn R5 fu
to either A12TP4 or A1
tested). Disconnect one
the good diode is discon
no signal will be presen
diode is good, the oscil
50% of the original amp

Do not move mix
connecting probe
break.

7. Turn off power. M
TP2 or TP3 to ground.
coax is making contact
measurements. Resista
40 ohms, the drive coa

Figure 8-25. 8411A-A1, A2, A3 and Stripline Troubleshootir

8411A PREAMPLIFIERS A4 AND A5

A4 SAMPLING DIODE BIAS SUPPLY

The sampling-diode bias supply produces a small positive and a small negative dc voltage to reverse-bias the sampling diodes in A1. Bias centering adjust A4R3 and bias level adjust A4R5 allow bias voltage adjustment of the diodes in sampler A1 for best sampling efficiency. This produces two equal-amplitude signals at the input of A4 that are added and applied to the bandpass filter A4L2, A4L3, A4L5, A4C5 and A4C6 at the input of the reference-channel preamplifier. Circuit capacitance due to the sampler and stray capacitance is shown across A4L2, forming a resonant circuit at 20.278 MHz.

BANDPASS FILTER

The bandpass filter has a bandwidth of 20 MHz in order to pass the required frequency range when the phase-lock loop is searching for a lock frequency. However, it still prevents unwanted signals from being passed on to the 8410B Network Analyzer.

A4 28 dB AMPLIFIER

The reference IF amplifier amplifies the 20.278 MHz signal by 28 dB. Gain through A4Q3, A4Q4, and A4Q5 is adjusted by the selection of the value of A4R21. The approximate gain through the three-transistor section is the ratio of A4R22 divided by A4R21. The gain of A4Q1 and Q2 is adjusted by the selection of the value of A4R14.

A5 SAMPLING BIAS SUPPLY

The sampling-diode bias supply produces a small positive and a small negative dc voltage to reverse-bias the sampling diodes in A2. Bias centering adjust A5R3 and bias level adjust A5R5 allow bias voltage adjustment of the diodes in sampler A2 for best sampling efficiency. This produces two equal-amplitude signals at the input of A5 that are added and applied to the bandpass filter at the input of the test-channel preamplifier.

Variable capacitor A5C13 is used to balance the test and reference channels for best isolation.

A5 BANDPASS FILTER

The bandpass filter composed of A5L1 and A5R7 also has the sampler and stray-capacitance shown in dotted lines. This capacity together with A5L1 resonates at 20.278 MHz. This passes the IF frequency and rejects unwanted signals from the test channel.

A5 6 dB AMPLIFIER

The 6-dB test-channel preamplifier has only 10 MHz bandwidth compared to 20 MHz in the reference channel. This gives a higher signal-to-noise ratio for the small levels passed by the test channel preamplifier. The gain of the amplifier can be adjusted by A5R20 and A5R21.

8411A PREAMPLIFIER A4 AND A5 TROUBLESHOOTING

PRELIMINARY CHECK

Check output of both preamplifiers at 8411A-A4TP3 and 8411A-A5TP3 using standard test setup described in Figure 8-12. If both outputs are incorrect, trouble is in the common stripline, step generator, or drive to the step generator. Go to Figure 8-24. If output is incorrect from only one of the preamplifiers, the trouble is in the associated strip line, sampler, or preamplifier. Check the preamplifier as follows.

TEST PREAMP A5 DEFECTIVE →

Connect 20.278 MHz signal source to the 8411A TEST channel APC-7 input connector. Connect dual trace oscilloscope to A5TP1 and A5TP3. Adjust output from signal source for a signal amplitude at A5TP1 of 1 division on the oscilloscope set to the most sensitive range. (Do not exceed 50 mW RF damage level at APC-7 connectors.) Determine voltage gain through preamplifier. Gain should be 2 or greater.

- **GAIN OF A5 LESS THAN 2** → Adjust A5R20 fully clockwise (maximum gain). If preamplifier gain is still low, check gain through each stage to isolate trouble.
- **GAIN OF A5 OK** → Preamplifier gain checks OK. Check stripline and Sampler A2 (Figure 8-25).

REFERENCE PREAMP A4 DEFECTIVE →

Connect 20.278 MHz signal source to the 8411A REFERENCE channel APC-7 input connector. Connect dual trace oscilloscope to A4TP3 and to the base of A4Q3. Adjust output of signal source for a signal amplitude at base of A4Q3 of 1 division on the oscilloscope set to most sensitive range. (Do not exceed 50 mW RF damage level at APC-7 connectors.) Determine voltage gain from base of A4Q3 to A4TP3. Disconnect oscilloscope from A4TP3 and connect it to A4TP1. Adjust signal source output for a signal amplitude of 1 division on oscilloscope. (Do not exceed 50 mW RF damage level at APC-7 connector.) Determine voltage gain through A4 by multiplying together the gain of the two sections measured. Gain should be 25 or greater.

- **GAIN OF A4 LESS THAN 25** → Change the value of A4R21 to 75 ohms (maximum gain). If preamplifier gain is still low, check gain through each stage to isolate trouble.
- **GAIN OF A4 OK** → A4 preamplifier gain OK. Check stripline and sampler A1 (Figure 8-25).

Figure 8-28. 8411A-A4 and A5 Troubleshooting

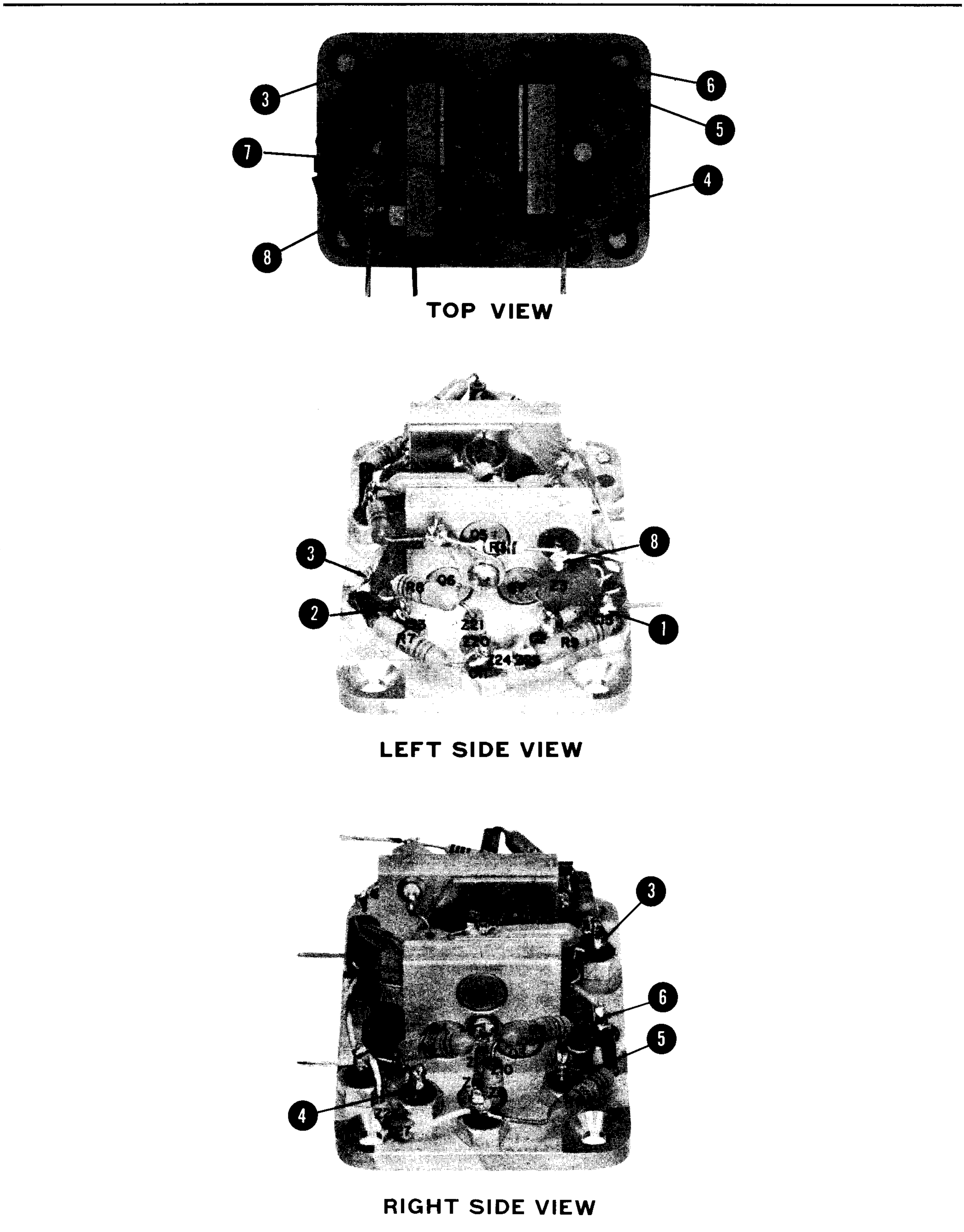
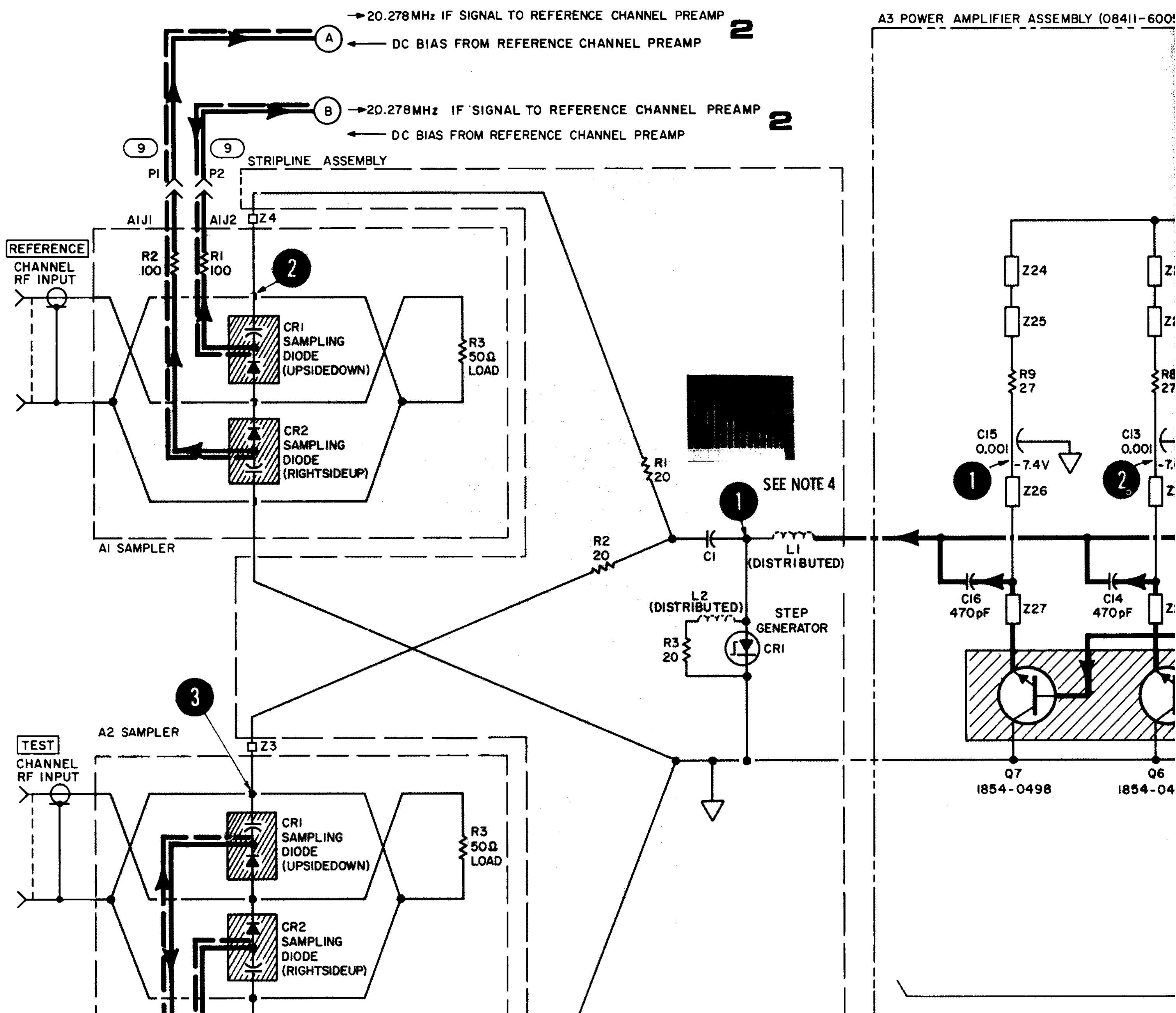


Figure 8-26. 8411A-A3 Parts Location

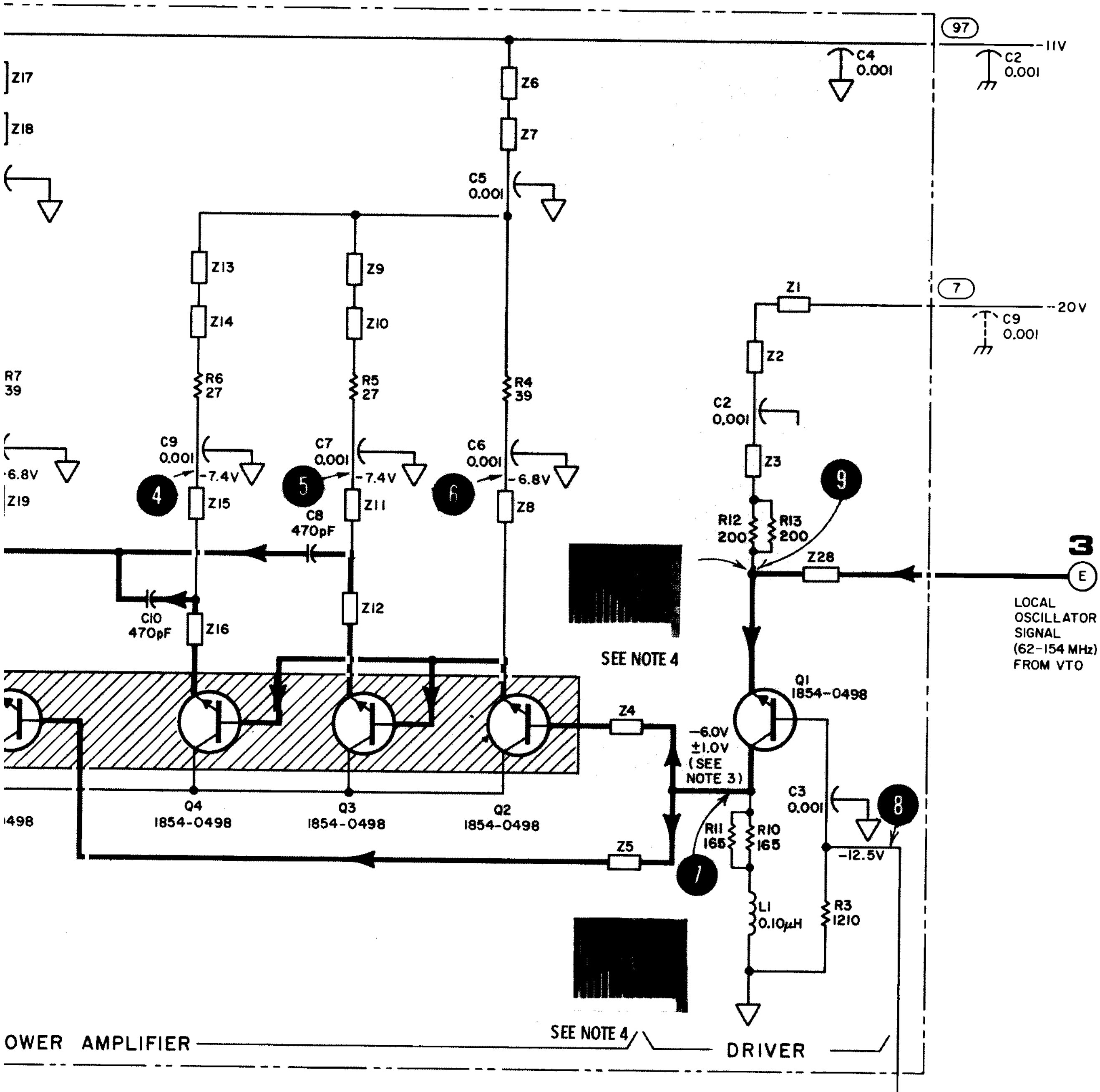


SERIAL PREFIX: 1905A DATE: MARCH 197

REFERENCE DESIGNATIONS

NO PREFIX	A3 ASSY	A6 ASSY
C1, 2, 9	C2-16	R14, 15
CR1	L1	
L1, 2	Q1-7	
P1-4	R1-9	
R1-3	Z1-28	
Z3,4		

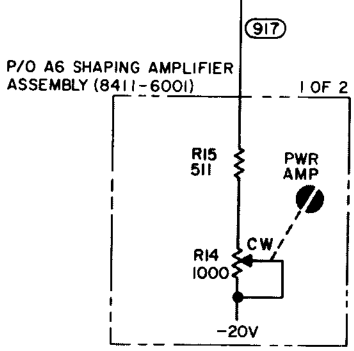
UNASSIGNED: A3C1



NOTES

1. SEE FIGURE 8-12 FOR GENERAL NOTES AND MEASUREMENT CONDITIONS
2. USE SAMPLING OSCILLOSCOPE WITH 10:1 DIVIDER TO VIEW WAVEFORMS AT STRIPLINE TP1–TP3; USE 100:1 DIVIDER AND ISOLATION CAPACITOR AT A3TP7 AND A3TP9.
3. VOLTAGE AT A3TP7 IS ADJUSTED AT THE FACTORY FOR BEST SAMPLE EFFICIENCY. DO NOT ADJUST DURING ROUTINE ALIGNMENT.
4. The settings for the spectrum analyzer are:

Resolution Bandwidth	- 3MHz
Reference Level	- 10dBm
Input Attenuation	- 10dB
Amplitude Scale	- 10dB/Div
Sweep Time/Div	- Auto
Frequency	- 1.000GHz
Frequency Span	- 200 MHz/Div



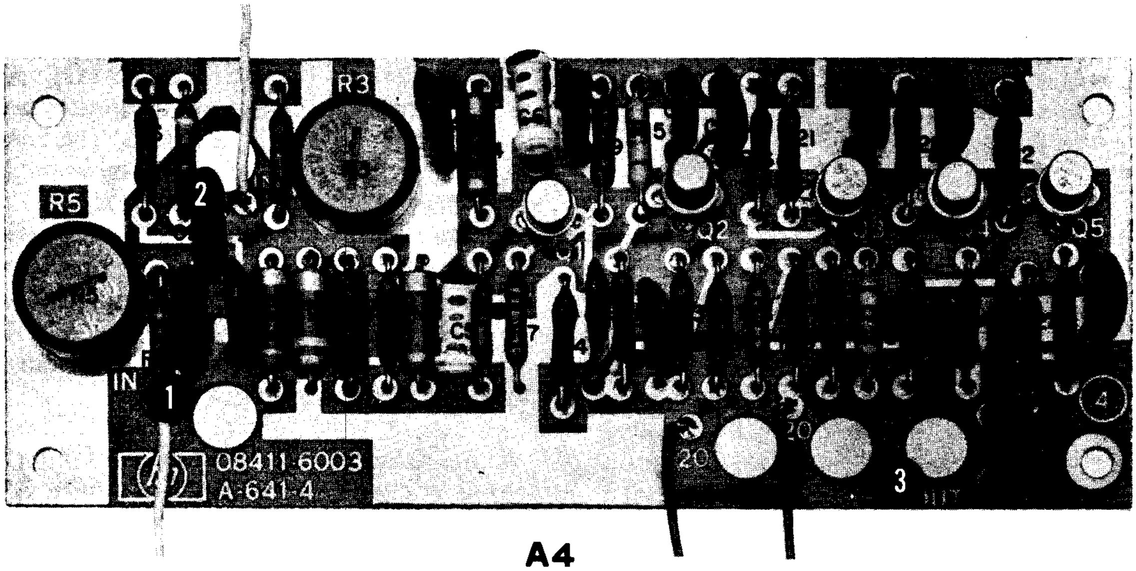
A2
ASSY
,2
3
2

1

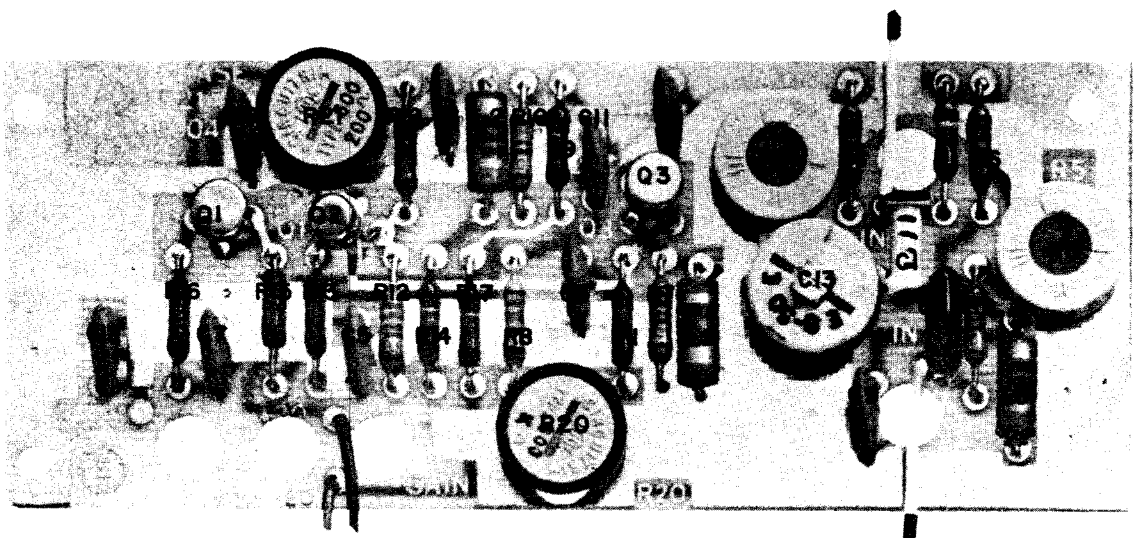
8411-A1, A2, A3, AND STRIPLINE

ALSO P/O A6

Figure 8-27. 8411A-A1, A2, A3, and Stripline Schematic Diagram

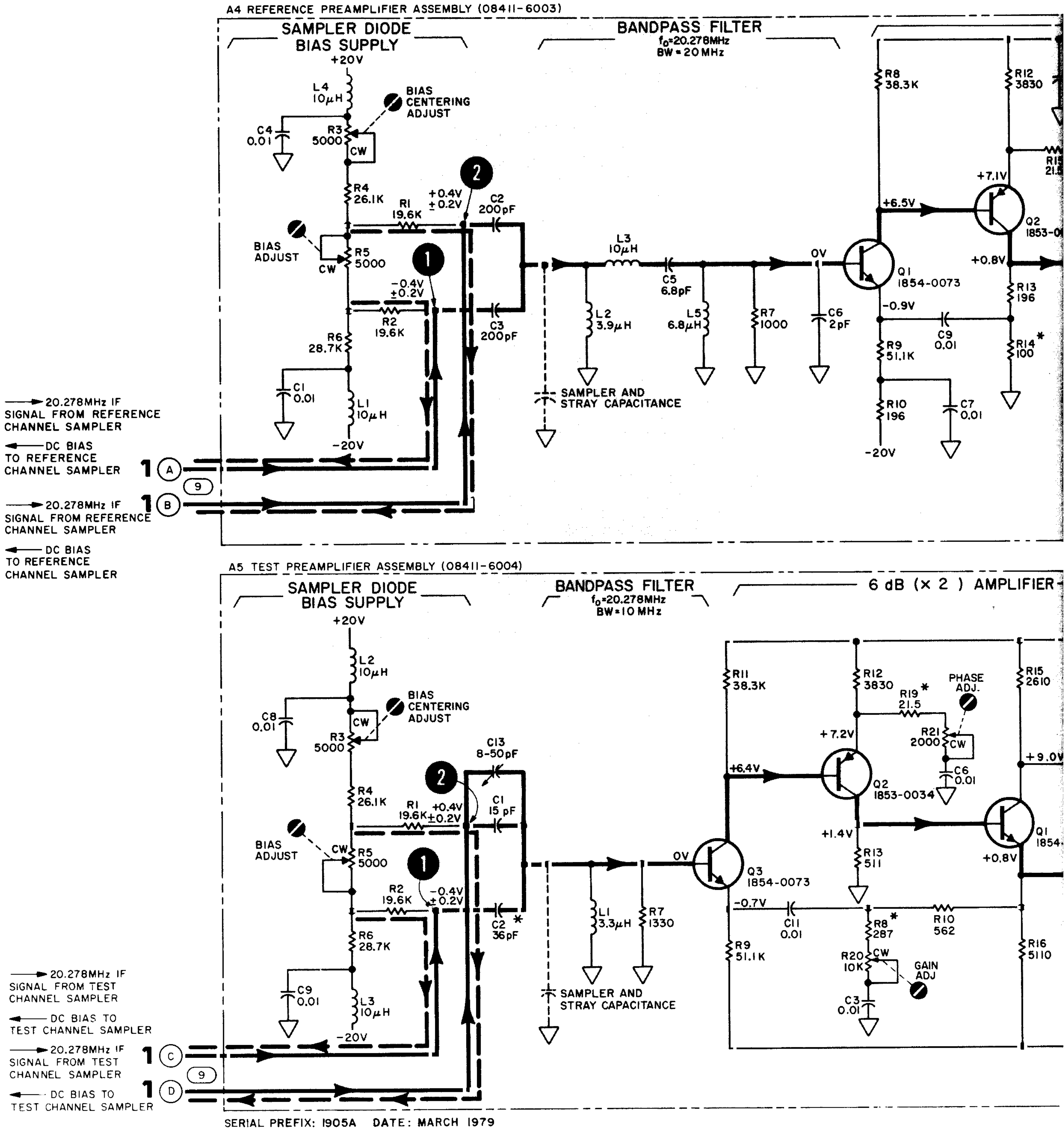


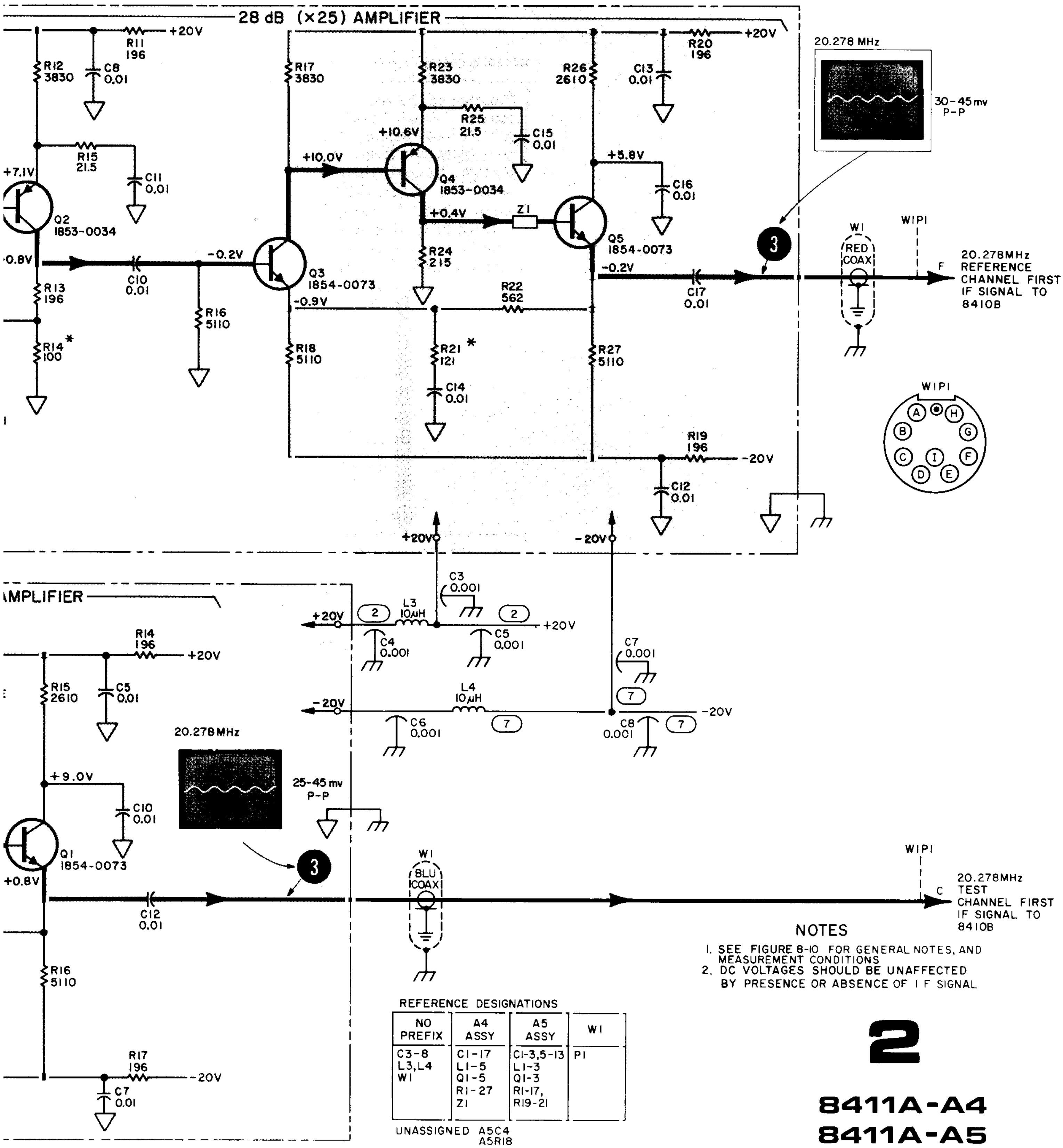
A4



A5

Figure 8-29. 8411A-A4 and A5 Parts Location


A4 REFERENCE PREAMPLIFIER ASSEMBLY (08411-6003)
SAMPLER DIODE BIAS SUPPLY
BANDPASS FILTER
f0=20.278MHz
BW=20MHz
+20V
L4 10μH
BIAS CENTERING ADJUST
C4 0.01
R3 5000
CW
R4 26.1K
R1 19.6K
+0.4V ±0.2V
C2 200pF
BIAS ADJUST
R5 5000
-0.4V ±0.2V
R2 19.6K
C3 200pF
R6 28.7K
C1 0.01
L1 10μH
-20V
L3 10μH
C5 6.8pF
L2 3.9μH
L5 6.8μH
R7 1000
C6 2pF
0V
SAMPLER AND STRAY CAPACITANCE
R8 38.3K
R12 3830
+7.1V
+6.5V
Q2 1853-0
Q1 1854-0073
+0.8V
-0.9V
R13 196
C9 0.01
R14* 100
R9 51.1K
R10 196
C7 0.01
-20V
20.278MHz IF SIGNAL FROM REFERENCE CHANNEL SAMPLER
DC BIAS TO REFERENCE CHANNEL SAMPLER
1 A
9
1 B
A5 TEST PREAMPLIFIER ASSEMBLY (08411-6004)
SAMPLER DIODE BIAS SUPPLY
BANDPASS FILTER
f0=20.278MHz
BW=10MHz
6 dB (× 2) AMPLIFIER
+20V
L2 10μH
BIAS CENTERING ADJUST
C8 0.01
R3 5000
C13 8-50pF
C1 15 pF
R4 26.1K
R1 19.6K
+0.4V ±0.2V
BIAS ADJUST
R5 5000
R2 19.6K
-0.4V ±0.2V
C2* 36pF
R6 28.7K
C9 0.01
L3 10μH
-20V
L1 3.3μH
R7 1330
SAMPLER AND STRAY CAPACITANCE
0V
Q3 1854-0073
R11 38.3K
R12 3830
R19* 21.5
PHASE ADJ.
R21 2000
C6 0.01
R15 2610
+7.2V
+6.4V
Q2 1853-0034
+1.4V
R13 511
Q1 1854-
+0.8V
+9.0V
-0.7V
C11 0.01
R8* 287
R10 562
R9 51.1K
R20 10K
GAIN ADJ
C3 0.01
R16 5110
20.278MHz IF SIGNAL FROM TEST CHANNEL SAMPLER
DC BIAS TO TEST CHANNEL SAMPLER
1 C
9
1 D
SERIAL PREFIX: 1905A DATE: MARCH 1979



NOTES

1. SEE FIGURE 8-10 FOR GENERAL NOTES, AND MEASUREMENT CONDITIONS
2. DC VOLTAGES SHOULD BE UNAFFECTED BY PRESENCE OR ABSENCE OF I F SIGNAL

REFERENCE DESIGNATIONS

NO PREFIX	A4 ASSY	A5 ASSY	W1
C3-8 L3,L4 W1	C1-17 L1-5 Q1-5 R1-27 Z1	C1-3,5-13 L1-3 Q1-3 R1-17, R19-21	P1

UNASSIGNED A5C4
A5R18

Figure 8-30. 8411A-A4 and A5 Schematic Diagram

8411A SHAPING AMPLIFIER A6 AND VTO A7, CIRCUIT DESCRIPTION

VARIABLE GAIN AMPLIFIER

Variable gain amplifier A6Q1 converts the error-voltage range produced by the 8410B phase-lock section to the range required to tune the VTO in the range of 65 to 155 MHz.

GAIN SHAPING NETWORK

The network composed of A6R1 through A6R8 and A6CR1 through A6CR4 in the emitter circuit of A6Q1, shapes the output voltage characteristics so that the VTO tunes linear with changing input voltage to A6. This allows the voltage-tuned-oscillator frequency to track with the RF input signal at the 8411A, obtaining the most stable phase-lock during swept-frequency operation. A6R6 affects the high-frequency section, A6R7 affects the mid-frequency section, and A6R8 affects the low-frequency section. A6CR8 sets the upper VTO frequency limit by clamping the maximum negative tuning voltage to the voltage set at A6R16.

VOLTAGE-TUNED OSCILLATOR

The voltage-tuned oscillator (VTO), A7Q1 and A7Q2 is a free-running multivibrator with a frequency range of 65 to 155 MHz. The frequency of the multi-vibrator is controlled by voltage-variable capacitive diodes, A7CR1 and A7CR2. DC control voltage from collector of A6Q1 is applied to the junction of A7CR1 and A7CR2, providing voltage control of the oscillator frequency. Increasing the reverse bias applied to A7CR1 and A7CR2 reduces the capacitance of the diodes, thus increasing the frequency of the multivibrator.

With an input control voltage of approximately +6.5 Vdc from the collector of A6Q1, A7R5 is adjusted for an oscillator frequency of 65 MHz. A7R3 is adjusted to clamp the upper-voltage limit of the control-voltage line to a voltage (approximately +6.5 Vdc) that limits the lowest frequency of the VTO to 62 ±1 MHz. The upper-frequency VTO limit of 154 ±1 MHz is controlled through clamping diode A6CR8 and A6R16.

:F
.ng
:1

NO

If DVM indication is approximately -19 Vdc, suspect A6CR8 shorted or A6Q1 open. If DVM indication is out of tolerance troubleshoot A6Q1 emitter circuit as follows:

(1) Mark location of A6R8 (BP1), A6R7 (BP2), and A6R6 (BP3). Adjust these controls to midrange, and A6R16 (VTO UPPER LIMIT) fully counterclockwise.
(2) Adjust A6R2 (BPL) for +11.2 V at A6TP3.
(3) Adjust SWEEP STABILITY control fully counterclockwise (high VTO frequency) but not into CW detent position.
(4) Monitor the dc voltage at A6TP2 and vary A6R6, A6R7 and A6R8. If these controls do not vary the dc voltage at A6TP2, check for an open potentiometer or associated diode.
(5) Set A6R6-A6R8 to original position.
(6) Check adjustment of phase lock loop, Paragraph 5-21.

A-
of

NO

Adjust VTO UPPER LIMIT control clockwise until DVM indicates -19 Vdc ±1 Vdc.

YES

If frequency counter indicates 154 MHz ±1 MHz trouble is corrected. If not, trouble is in 8411A-A7Q1 or A7Q2 circuits.

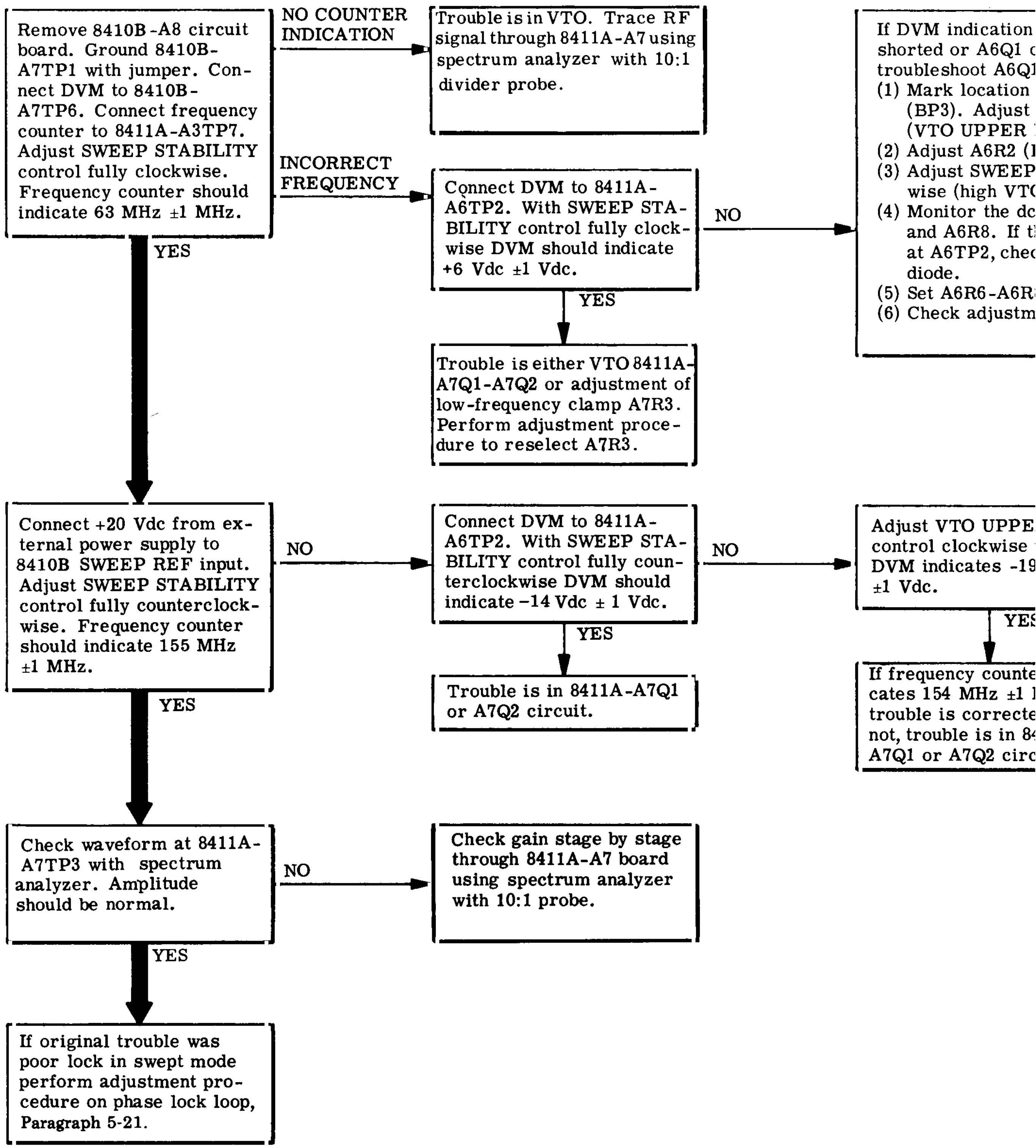
NO

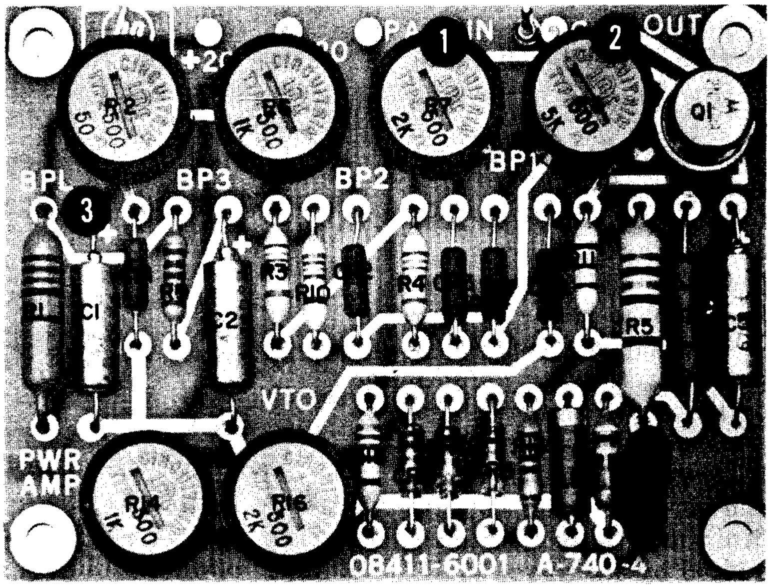
If DVM indication is approximately +7 Vdc, suspect shorted A6Q1. If DVM indication is out of tolerance, troubleshoot A6Q1 emitter circuit as follows:

(1) Mark location of A6R8 (BP1), A6R7 (BP2), and A6R6 (BP3). Adjust these controls to midrange, and A6R16 (VTO UPPER LIMIT) fully counterclockwise.
(2) Adjust A6R2 (BPL) for +11.0 V at A6TP3.
(3) Adjust SWEEP STABILITY control fully counterclockwise (high VTO frequency) but not into CW detent position.
(4) Monitor the dc voltage at A6TP2 and vary A6R6, A6R7 and A6R8. If these controls do not vary the dc voltage at A6TP2, check for an open potentiometer or associated diode.
(5) Set A6R6-A6R8 to original position.
(6) Check adjustment of phase lock loop, Paragraph 5-21.

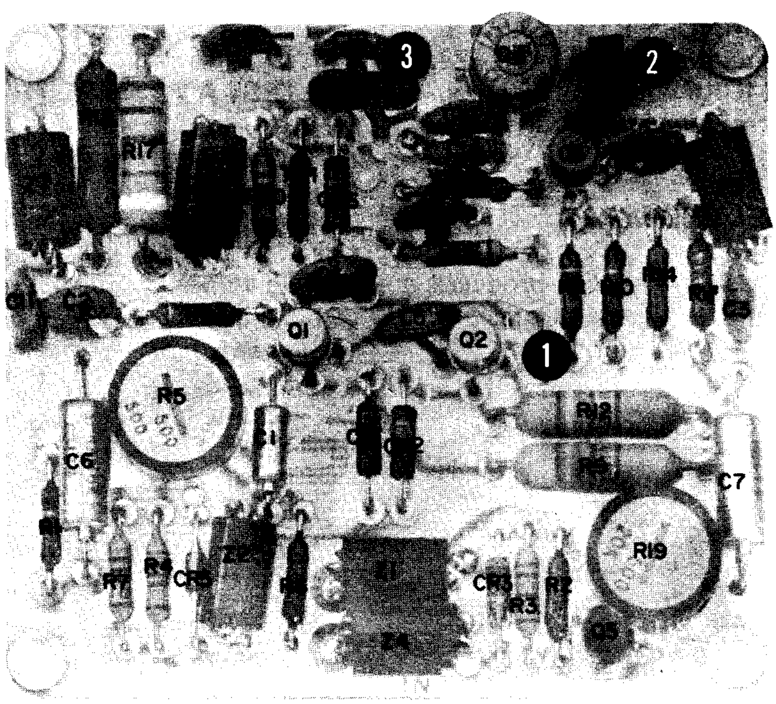
Figure 8-31. 8411A-A6 and A7 Troubleshooting

8411A SHAPING AMPLIFIER A6 AND 8411A VOLTAGE TUNED OSCILLATOR A7 TROUBLESHOOTING



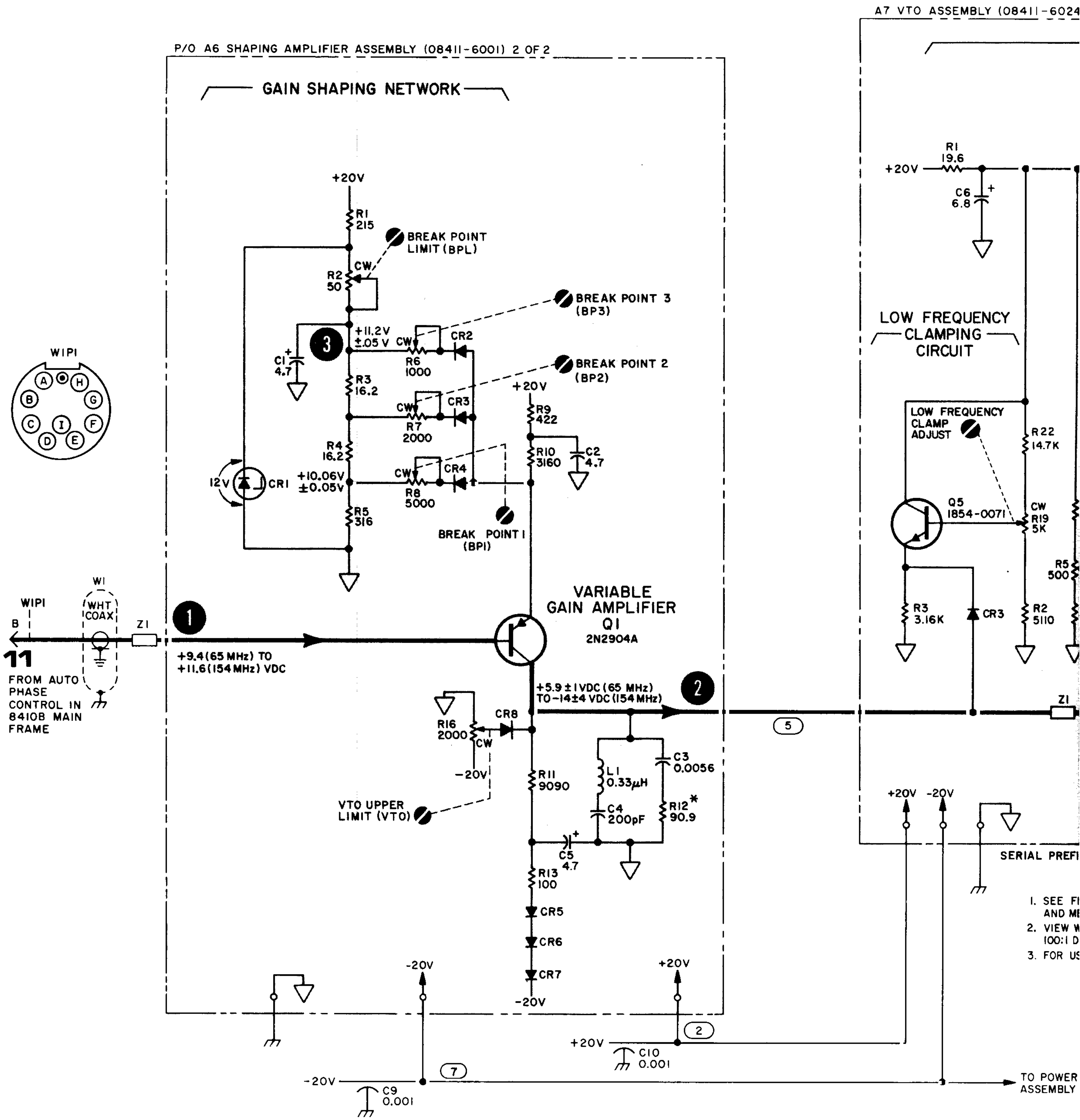


A6

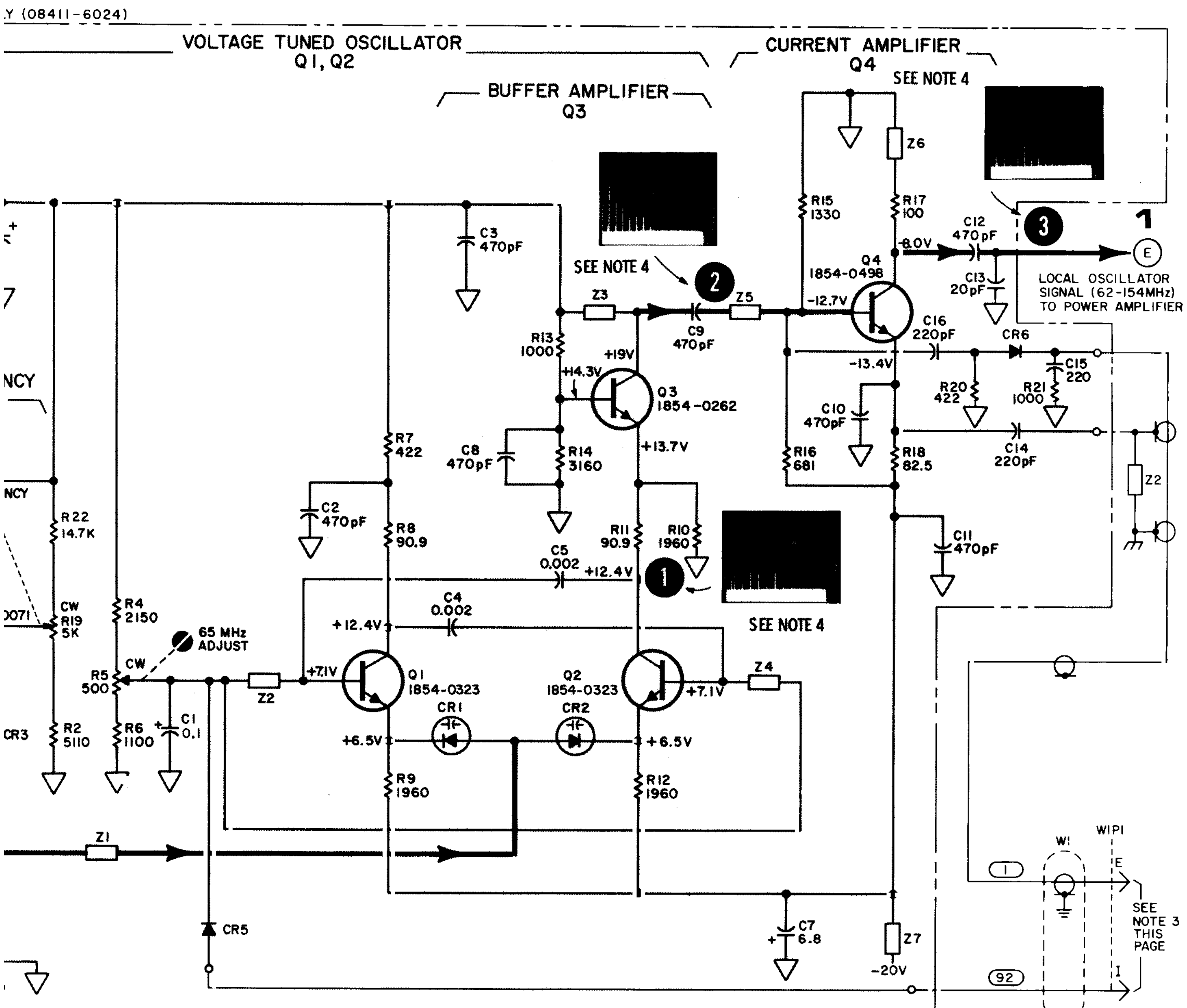


A7

Figure 8-32. 8411A-A6 and A7 Parts Location



P/O A6 SHAPING AMPLIFIER ASSEMBLY (08411-6001) 2 OF 2
GAIN SHAPING NETWORK
+20V
R1 215
BREAK POINT LIMIT (BPL)
R2 50
CW
BREAK POINT 3 (BP3)
+11.2V ±.05 V
C1 4.7
R6 1000
CR2
BREAK POINT 2 (BP2)
R3 16.2
R7 2000
CR3
R4 16.2
R8 5000
CR4
12V
CR1
+10.06V ±0.05V
R5 316
BREAK POINT 1 (BP1)
R9 422
R10 3160
C2 4.7
W1P1
W1
WHT COAX
Z1
B
11
FROM AUTO PHASE CONTROL IN 8410B MAIN FRAME
+9.4(65 MHz) TO +11.6(154 MHz) VDC
VARIABLE GAIN AMPLIFIER
Q1
2N2904A
+5.9 ±1VDC (65 MHz) TO -14±4 VDC (154 MHz)
R16 2000
CR8
-20V
VTO UPPER LIMIT (VTO)
R11 9090
L1 0.33μH
C3 0.0056
C4 200pF
R12* 90.9
C5 4.7
R13 100
CR5
CR6
CR7
-20V
+20V
+20V
C10 0.001
-20V
C9 0.001
A7 VTO ASSEMBLY (08411-6024
R1 19.6
C6 6.8
LOW FREQUENCY CLAMPING CIRCUIT
LOW FREQUENCY CLAMP ADJUST
R22 14.7K
Q5 1854-0071
CW
R19 5K
R5 500
R3 3.16K
CR3
R2 5110
Z1
+20V -20V
SERIAL PREFI
1. SEE FI AND ME
2. VIEW W 100:1 D
3. FOR US
TO POWER ASSEMBLY



SERIAL PREFIX: 1905A DATE: MARCH 1979

NOTES

1. SEE FIGURE 8-12 FOR GENERAL NOTES AND MEASUREMENT CONDITIONS.
2. VIEW WAVEFORMS WITH SAMPLING OSCILLOSCOPE, 100:1 DIVIDER, AND ISOLATION CAPACITOR.
3. FOR USE WITH AUTOMATIC NETWORK ANALYZER ONLY
4. The settings for the spectrum analyzer are:

Resolution Bandwidth	- 3MHz
Reference Level	- 10dBm
Input Attenuation	- 10dB
Amplitude Scale	- 10dB/Div
Sweep Time/Div	- Auto
Frequency	- 1.000GHz
Frequency Span	- 200 MHz/Div

→ TO POWER AMPLIFIER ASSEMBLY A3

REFERENCE DESIGNATIONS

NO PREFIX	A6 ASSY	A7 ASSY	W1
C9, 10 W1 W1P1 Z1,2	C1-5 CR1-8 L1 Q1 R1-13,16	C1-16 CR1-3,5,6 Q1-4 R1-18 Z1-7	P1

A7CR4 NOT ASSIGNED

3

P/O 8411A-A6
8411A-A7

Figure 8-33. 8411A-A6 and A7 Schematic Diagram

8410B TEST AND REFERENCE AGC AMPLIFIERS A12 AND A14, CIRCUIT DESCRIPTION

REFERENCE CHANNEL 20.278 MHz IF AMPLIFIER

The two series diodes, A14CR5 and A14CR6, act as a variable resistance between A14C17 and ground by-pass A14C20. Effective resistance through the diodes is changed by changing the dc current through the diodes. This is controlled by the AGC signal, which is applied at the base of A14Q7. A positive AGC signal at A14Q7 base causes A14Q7 to conduct, forward biasing diodes A14CR5 and A14CR6. This gives minimum impedance through the series resonant bandpass circuit, A14C17 and A14L2 to ground, and therefore produces maximum gain through feedback pair A14Q5—A14Q6. Minimum gain through A14Q5—A14Q6 is produced by a zero-volt AGC signal.

A14Q5 and A14Q6 compose a feedback-pair amplifier. A14R23 provides fixed feedback between transistors. Gain of the A14Q5—A14Q6 stage is controlled by an RF bandpass circuit from the emitter of A14Q6 through CR5 and CR6 to ground. The bandpass circuit is formed by A14L2, A14C17, A14CR5, A14CR6 and A14C20 connected in series and is resonant at about 20.278 MHz.

REFERENCE CHANNEL 2ND MIXER

Differential amplifier A14Q1—A14Q2 produces two equal amplitude, 20-MHz signals of opposite polarity at the collector of each transistor. These signals are coupled through A14C4 and A14C5 to the diode mixer.

A14CR1—A14CR4 is a balanced mixer. The 20-MHz signal from differential amplifier A14Q1 and A14Q2 mixes with the 20.278-MHz reference-channel signal. The output signal at the junction of A14CR3 and A14CR4 is the sum and difference of the two mixing signals as well as the two original signals. A14C6 bypasses the higher frequency signals allowing the 278 KHz difference signal to pass to the phase vernier circuit in A16.

Emitter follower A14Q3 is a buffer stage between bandpass filter A14C10—A14L1 and diode mixer A14CR1—A14CR4. Bandpass filter A14C10—A14L1 has a resonant frequency of about 20.278 MHz. Capacitor A14C10 has the distributed capacitance of the cable to A15 across it, forming a lump capacitance of about 50 pF.

A12 TEST AGC AMPLIFIER

A12 is identical to A14 except for the 20.278-MHz bandpass filter. A14 has an AGC output coaxial cable connected across the parallel resonant circuit (A14C10 and A14L1), providing about 18 pF in parallel with A14C10. A12 has no output cable attached, therefore A12C10 is 51 pF.

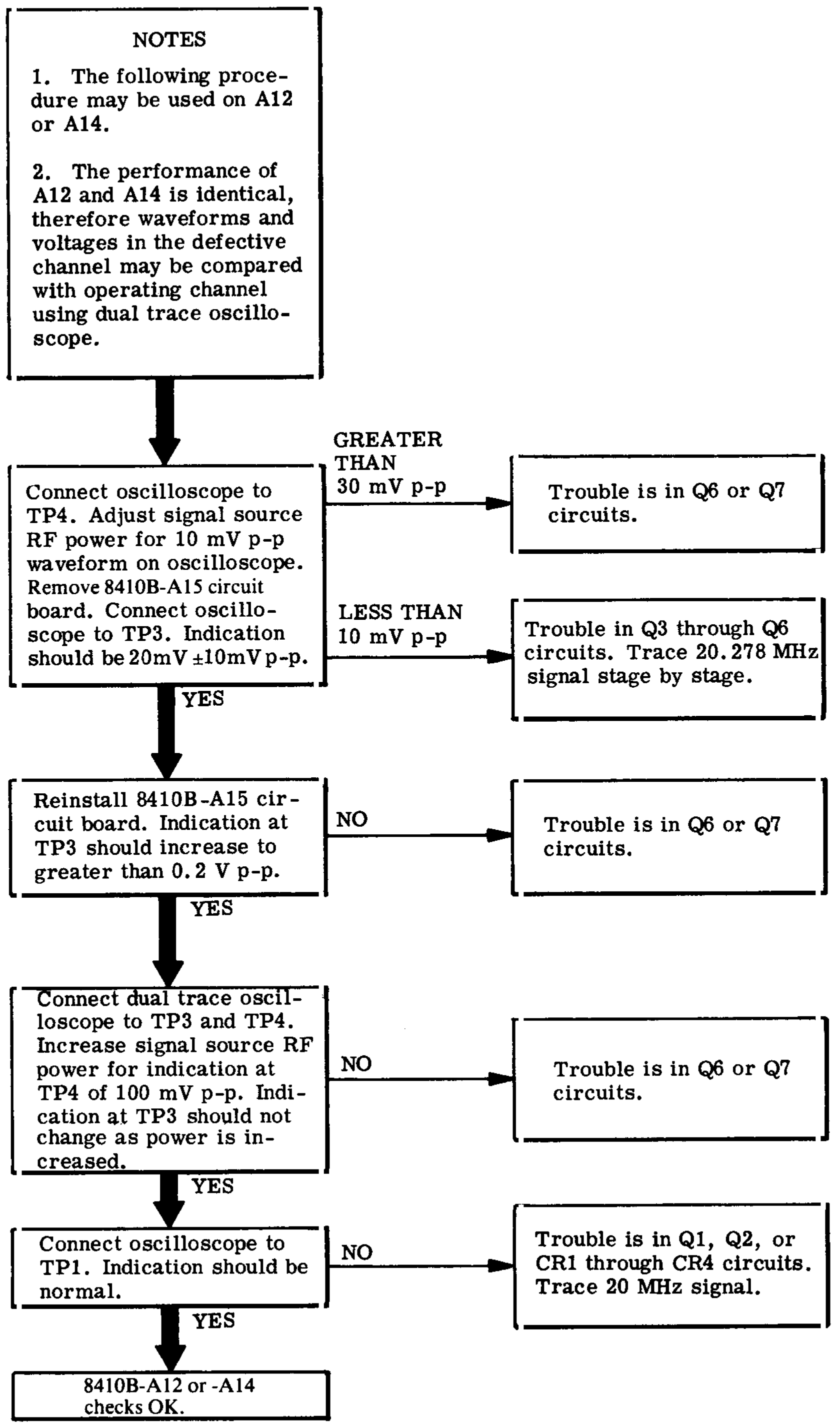
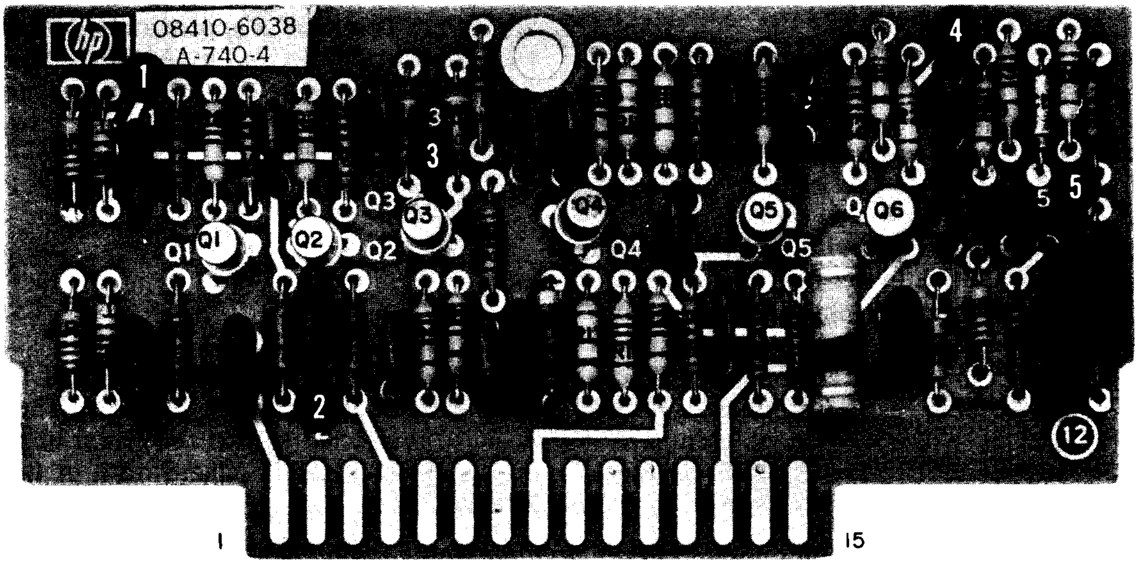
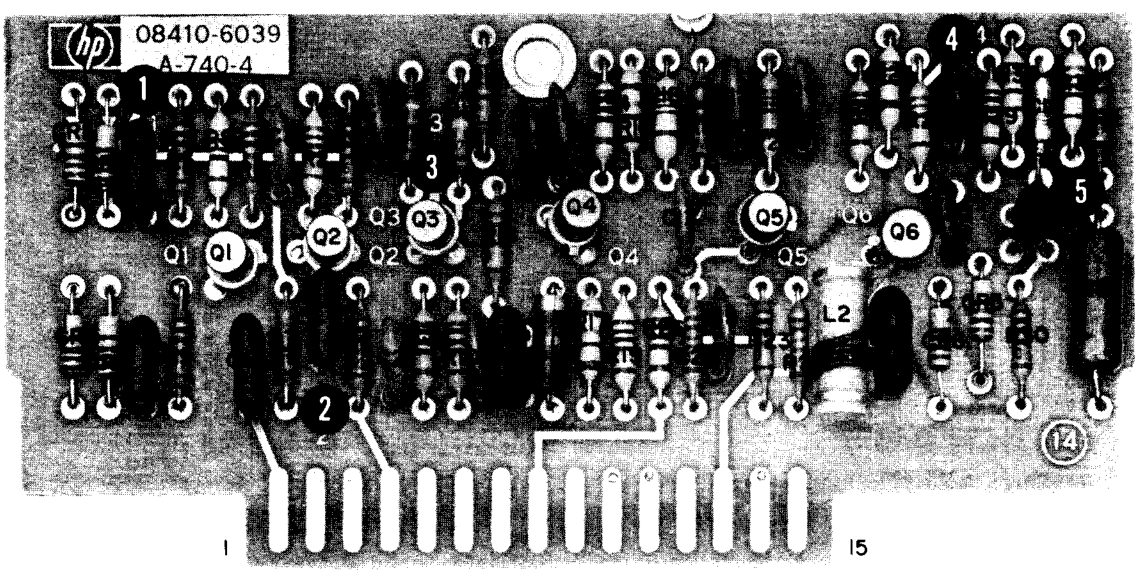


Figure 8-34. 8410B-A12 and A14 Troubleshooting

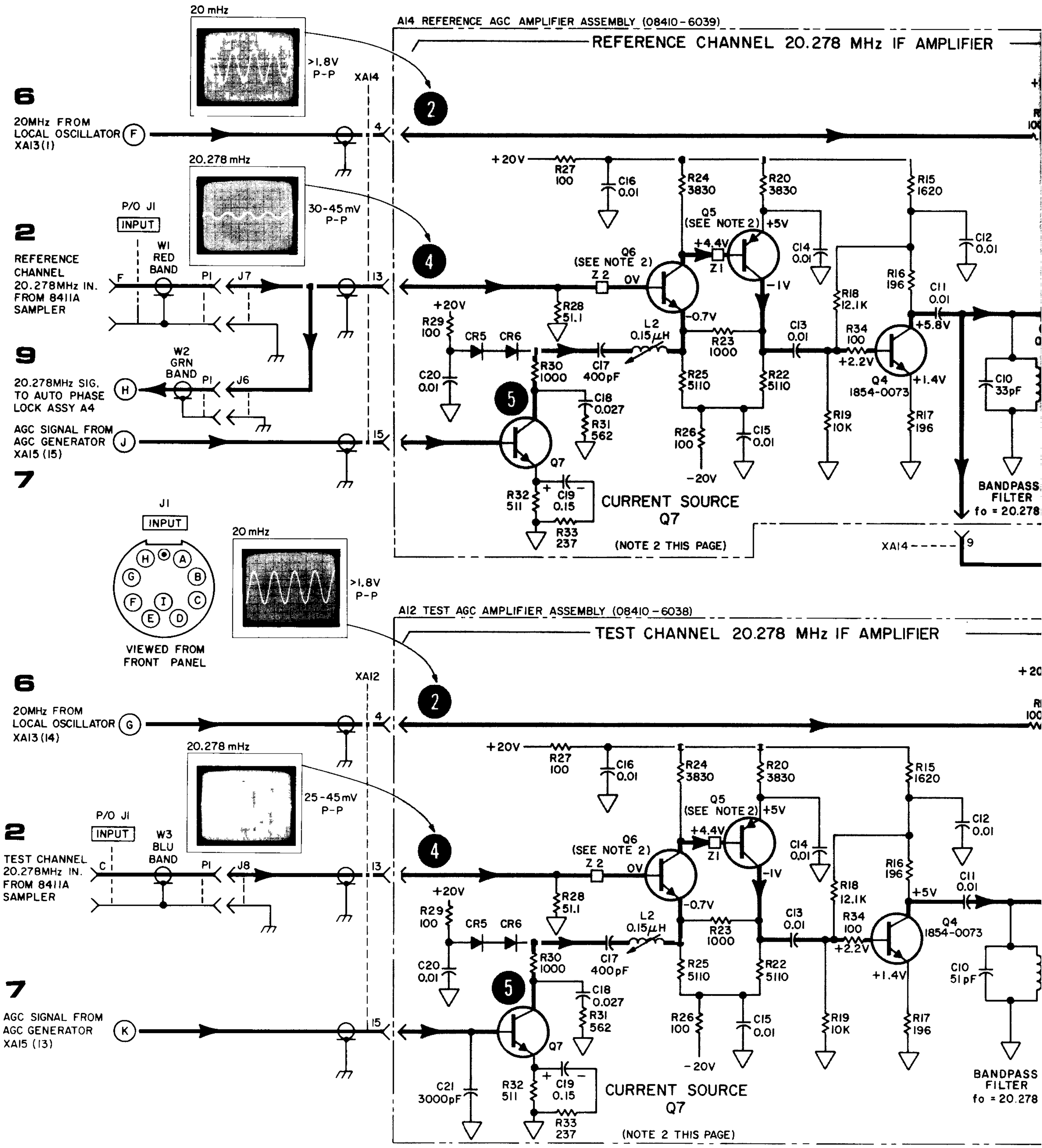


A12

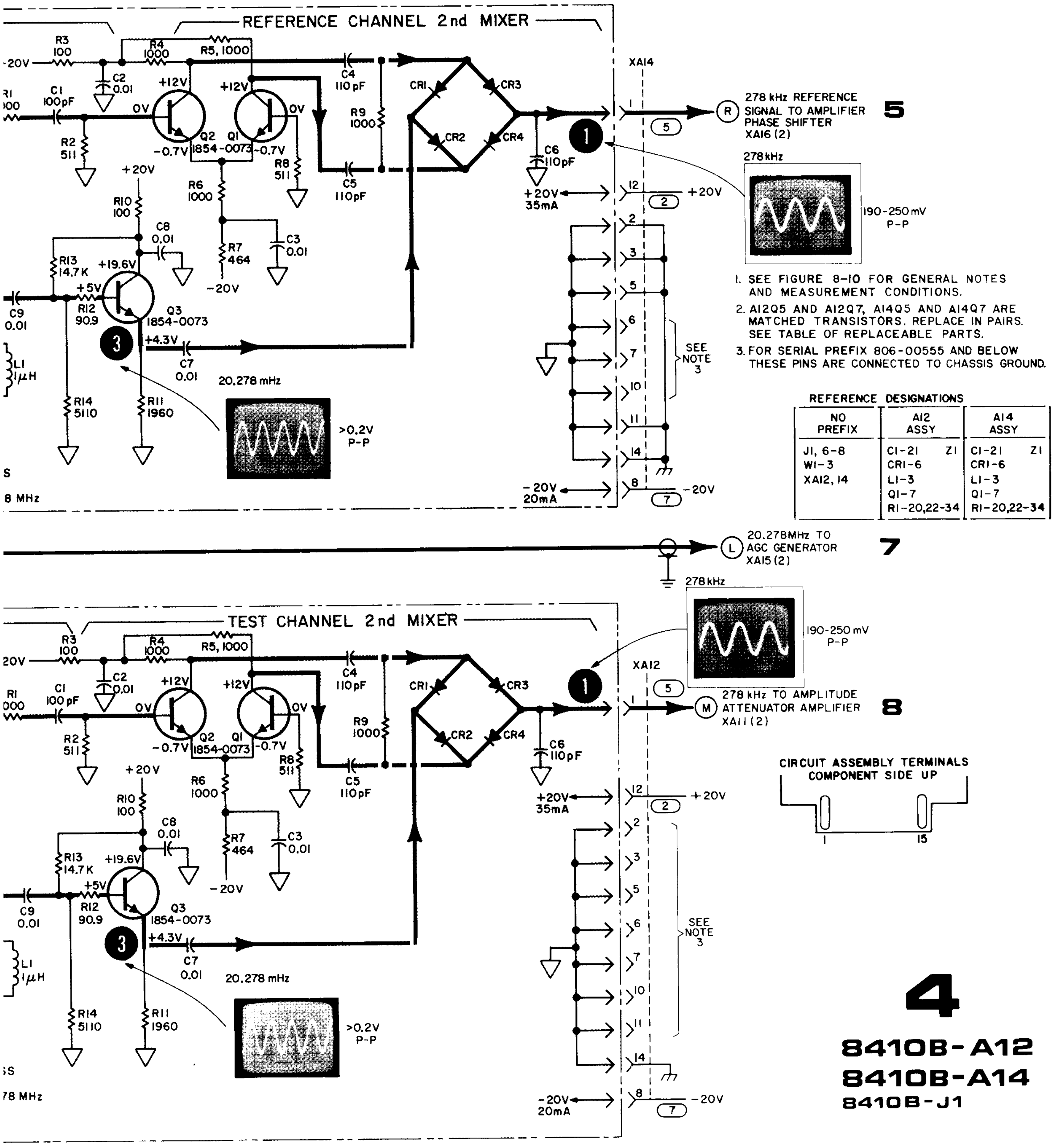


A14

Figure 8-35. 8410B-A12 and A14 Parts Location



SERIAL PREFIX: 1902A DATE: MARCH 1979



1. SEE FIGURE 8-10 FOR GENERAL NOTES AND MEASUREMENT CONDITIONS.
2. A12Q5 AND A12Q7, A14Q5 AND A14Q7 ARE MATCHED TRANSISTORS. REPLACE IN PAIRS. SEE TABLE OF REPLACEABLE PARTS.
3. FOR SERIAL PREFIX 806-00555 AND BELOW THESE PINS ARE CONNECTED TO CHASSIS GROUND.

REFERENCE DESIGNATIONS

NO PREFIX	A12 ASSY	A14 ASSY
J1, 6-8 W1-3 XA12, 14	C1-21 Z1 CR1-6 L1-3 Q1-7 R1-20,22-34	C1-21 Z1 CR1-6 L1-3 Q1-7 R1-20,22-34

Figure 8-36. 8410B-A12 and A14 Schematic Diagram

8410B REFERENCE 278 kHz AMPLIFIER A16, CIRCUIT DESCRIPTION

AMPLIFIER/PHASE SHIFTER

A16Q1 forms an emitter follower with unity gain through the stage.

A16Q2 and A16C2 form a variable phase-shift circuit. Phase shift from the stage input to output is obtained by adding vectorily signals passing through A16C2 and through A16Q2. Phase shift and amplitude of the signal vector through A16C2 remains constant, while the amplitude of the signal vector through A16Q2 is variable and is controlled by the setting of PHASE VERNIER control R2. With R2 set at maximum resistance, phase shift is about +10 degrees. With R2 set at minimum resistance, phase shift is about +110 degrees through the stage.

A16Q3 and A16Q4 form a feedback-pair amplifier. The gain is approximately equal to the value of A16R13 divided by A16R12. The value of A16R13 is selected so that 200 mV peak to peak at A16TP1 produces 2.0V ±0.3V peak to peak at A16TP3.

BANDPASS FILTER

A16C8, A16C9, A16C10, and A16L1 form a parallel-resonant circuit at 278 kHz. The value of A16C10 is selected so that the center of resonance occurs at 278 kHz. The bandwidth of the filter is 20 kHz.

8410B REFERENCE 278 KHZ AMPLIFIER A16, TROUBLESHOOTING

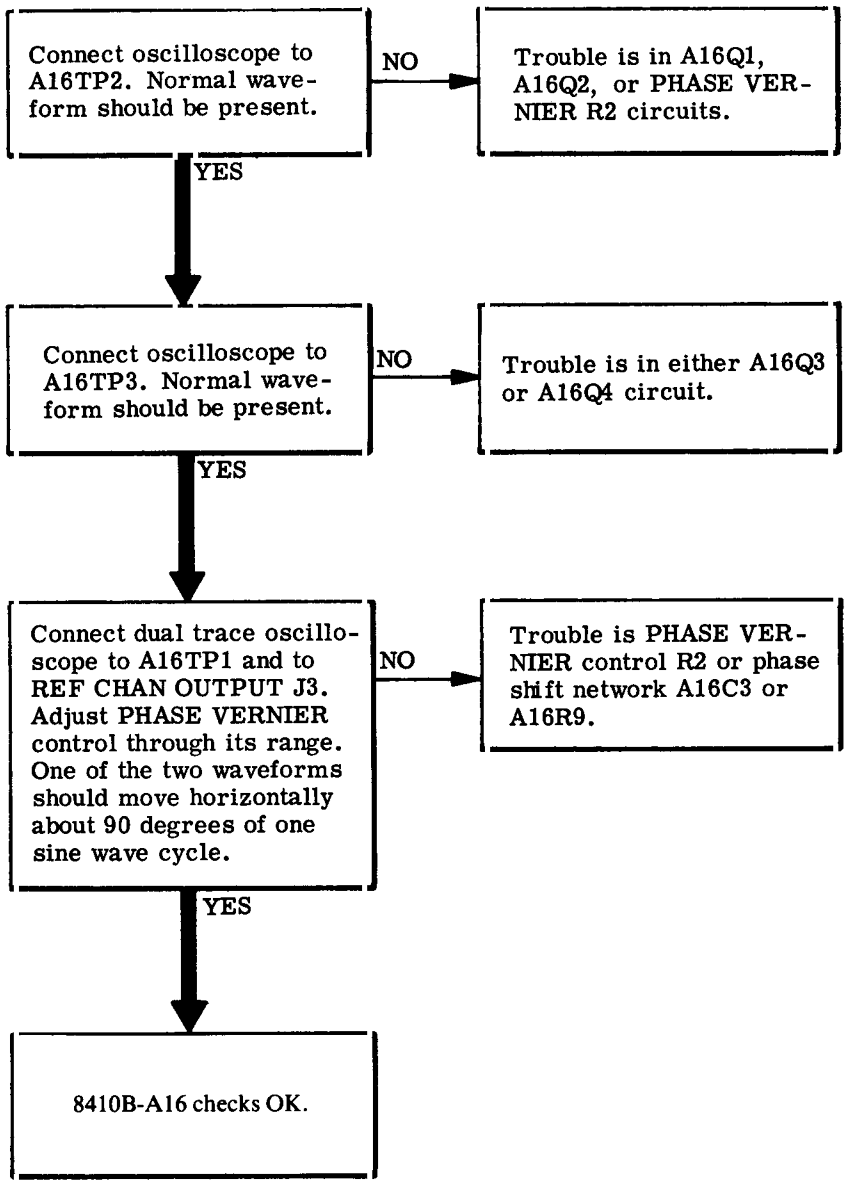
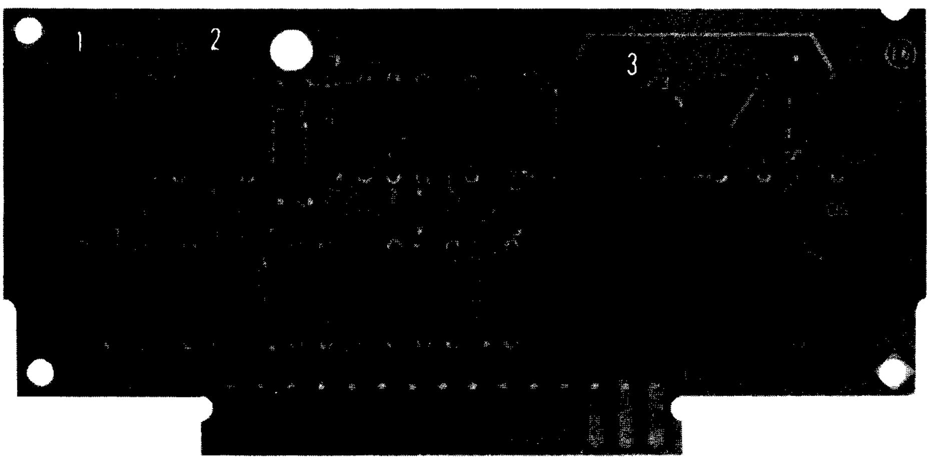


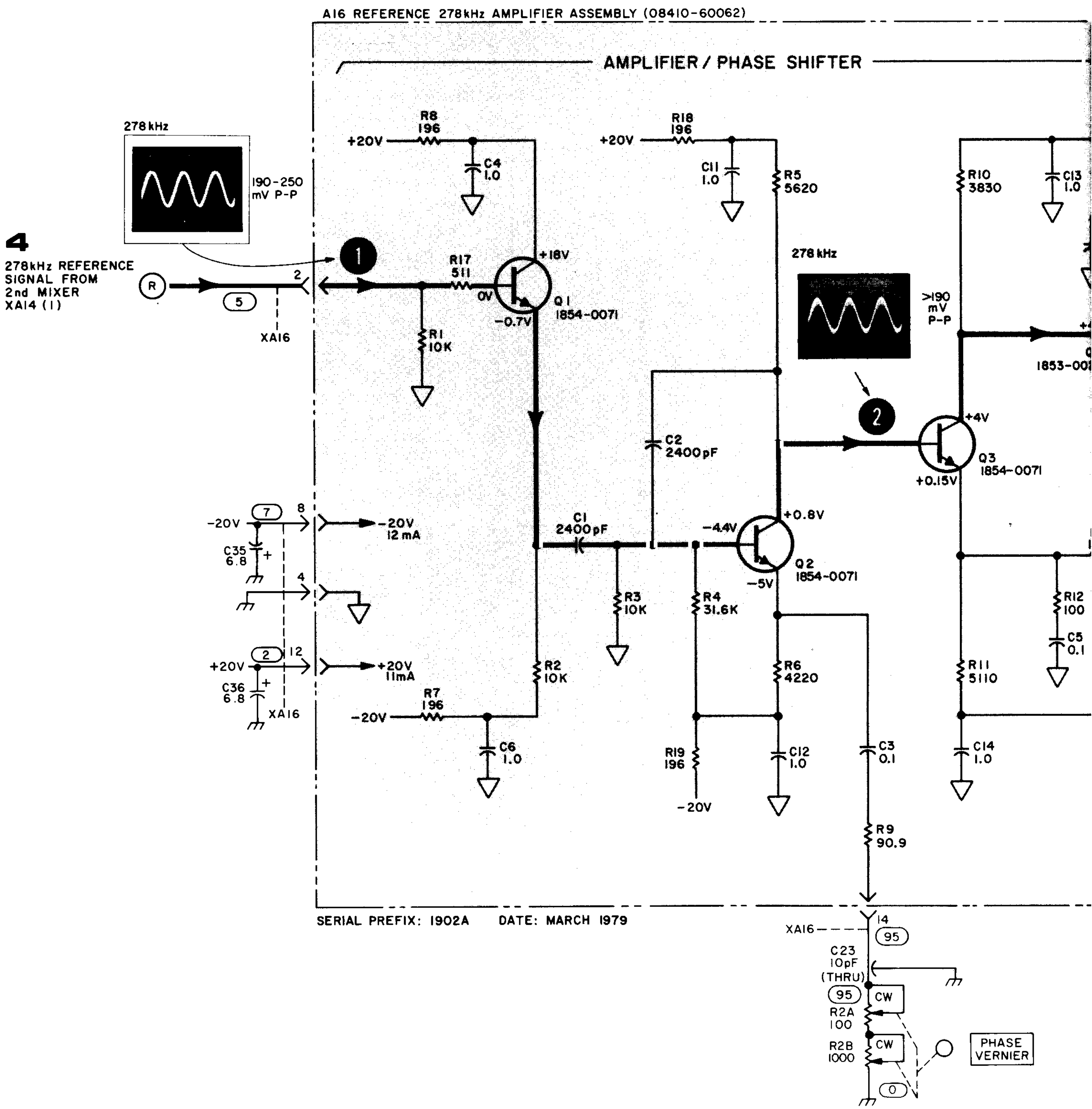
Figure 8-37. 8410B-A16 Troubleshooting

A16

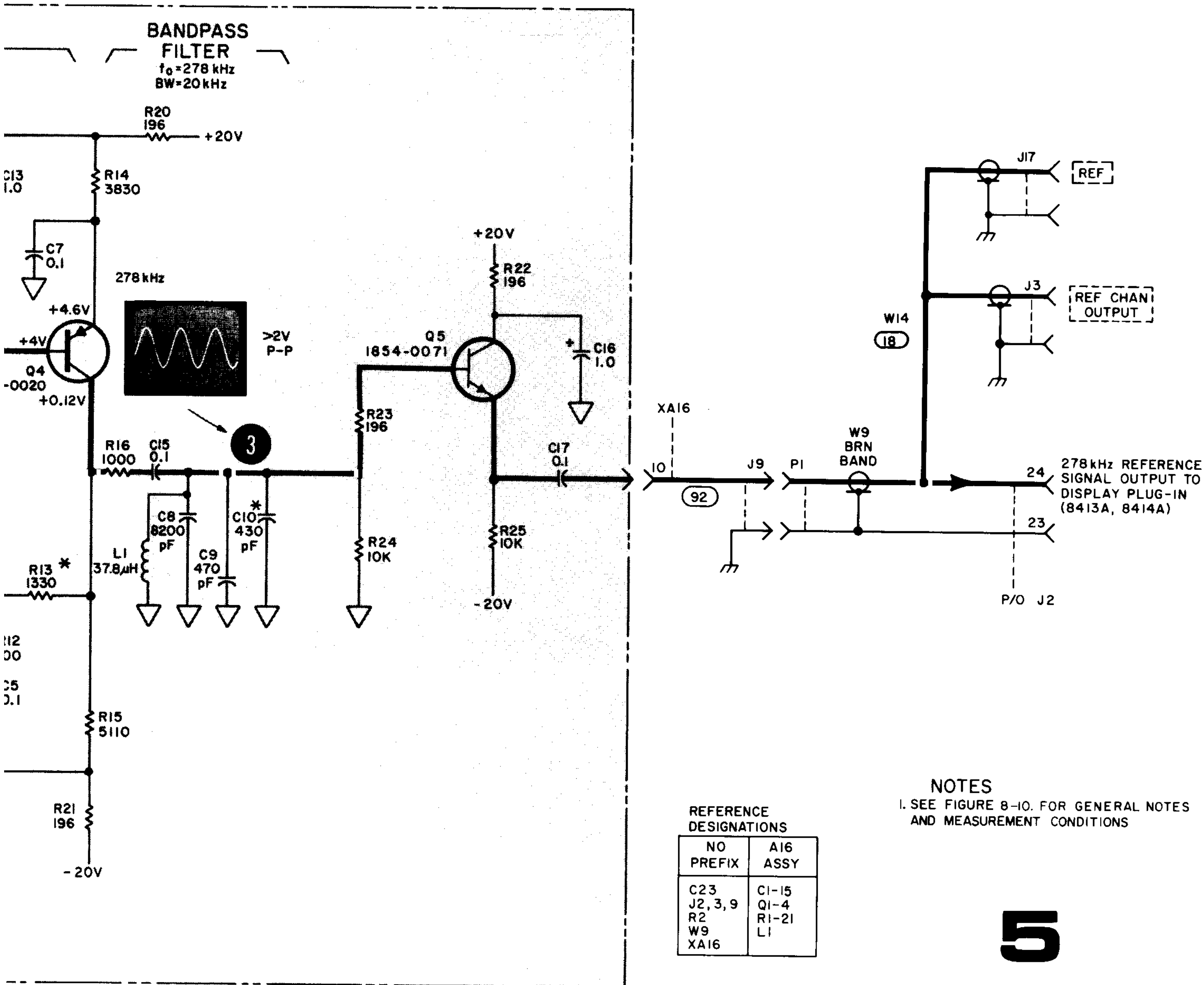


*FACTORY SELECTED VALUE.
PART MAY BE OMITTED.

Figure 8-38. 8410B-A16 Parts Location



A16 REFERENCE 278kHz AMPLIFIER ASSEMBLY (08410-60062)
AMPLIFIER / PHASE SHIFTER
278kHz
190-250 mV P-P
4
278kHz REFERENCE SIGNAL FROM 2nd MIXER XA14 (1)
R
5
XA16
R8 196
+20V
C4 1.0
R17 511
+18V
0V
Q1 1854-0071
-0.7V
R1 10K
R18 196
C11 1.0
R5 5620
278kHz
>190 mV P-P
R10 3830
C13 1.0
1853-00
+4V
Q3 1854-0071
+0.15V
C2 2400pF
C1 2400pF
-4.4V
+0.8V
Q2 1854-0071
-5V
R3 10K
R4 31.6K
R6 4220
R12 100
C5 0.1
R11 5110
-20V
7
8
-20V 12 mA
C35 6.8
4
+20V
2
12
+20V 11mA
C36 6.8
R2 10K
R7 196
C6 1.0
R19 196
C12 1.0
C3 0.1
C14 1.0
R9 90.9
SERIAL PREFIX: 1902A
DATE: MARCH 1979
14
95
C23 10pF (THRU)
CW
R2A 100
R2B 1000
PHASE VERNIER
0



REFERENCE DESIGNATIONS

NO PREFIX	A16 ASSY
C23 J2, 3, 9 R2 W9 XA16	C1-15 Q1-4 R1-21 L1

NOTES

1. SEE FIGURE 8-10. FOR GENERAL NOTES AND MEASUREMENT CONDITIONS

5

8410B-A16

ALSO: 8410B-C23, C35, C36, P/O J2, J9, R2, W9, AND W14.

Figure 8-39. 8410B-A16 Schematic Diagram

8410B 20 MHz OSCILLATOR A13, CIRCUIT DESCRIPTION

20 MHz OSCILLATOR AND 20 dB AMPLIFIER

A13Q3 and A13Y1 form a 20-MHz crystal oscillator circuit. The feedback loop is formed by A13C7, A13C8, and A6Y1. A13C7 allows adjustment of the oscillator frequency so that the difference frequency between the 20.278-MHz oscillator and this 20-MHz oscillator is 278 kHz.

A13C12, A13CR1, and A13CR2, together with the associated resistor-capacitor network, form a negative feedback circuit which maintains a constant-amplitude oscillator signal to the second mixer. Feedback signals from A13C12 are detected by A13CR1 and A13CR2 and develop a dc signal across A13R3. This changes the dc bias at A13Q3 base, depending on feedback amplitude. The signal at A13TP3 stabilizes with constant output at about 1.8 to 2.8 volts peak-to-peak.

BUFFER

A13Q1 and A13Q2 compose a feedback-pair amplifier. The approximate gain of the circuit is determined by the ratio of A13R25 divided by A13R23.

A13C21 and A13L2 form a parallel-resonant circuit at 20 MHz. This acts as a bandpass circuit for the 20-MHz oscillator signal, but rejects harmonics of the oscillator signal.

8410B 20-MHZ OSCILLATOR A13 TROUBLESHOOTING

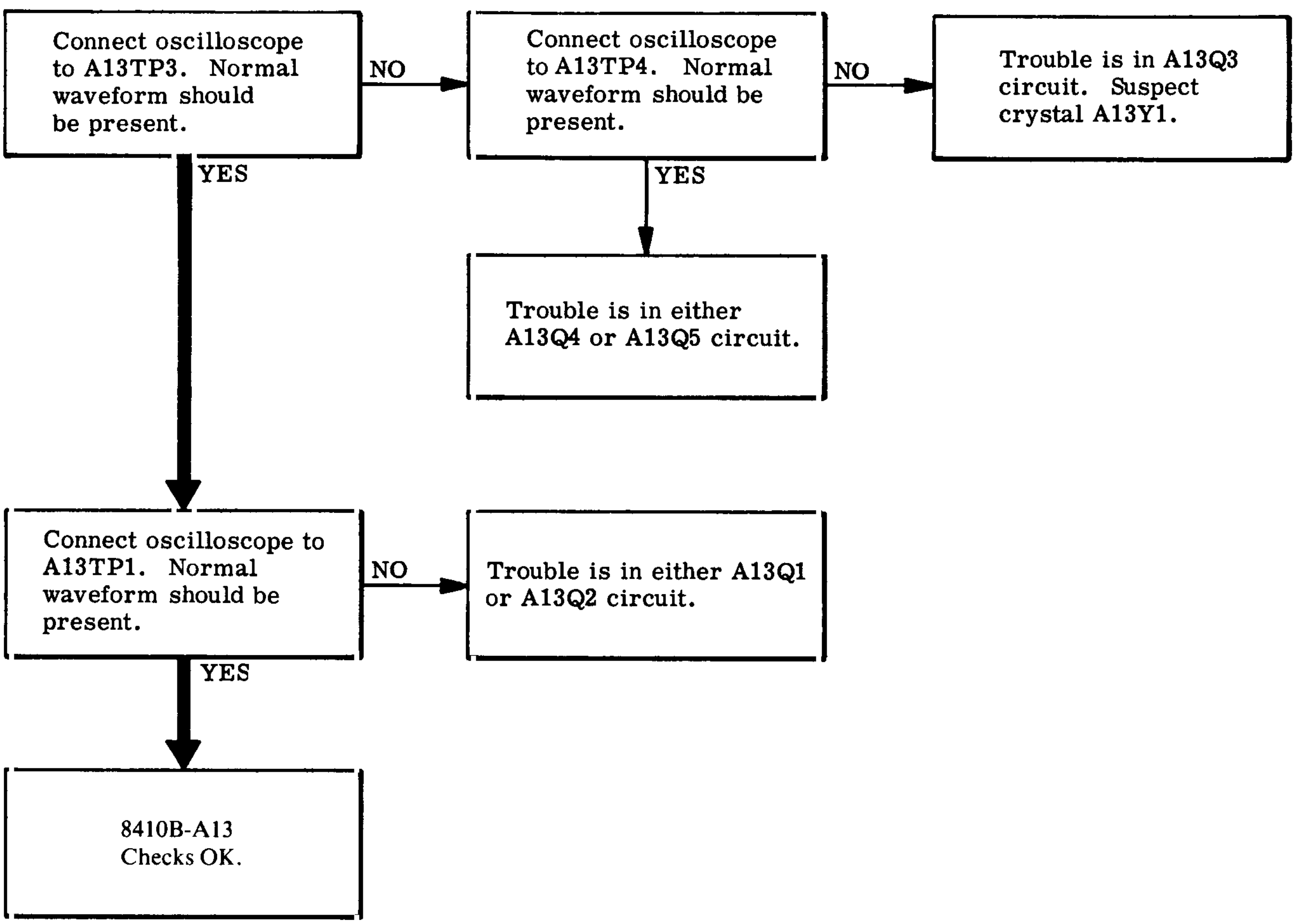


Figure 8-40. 8410B-A13 Troubleshooting

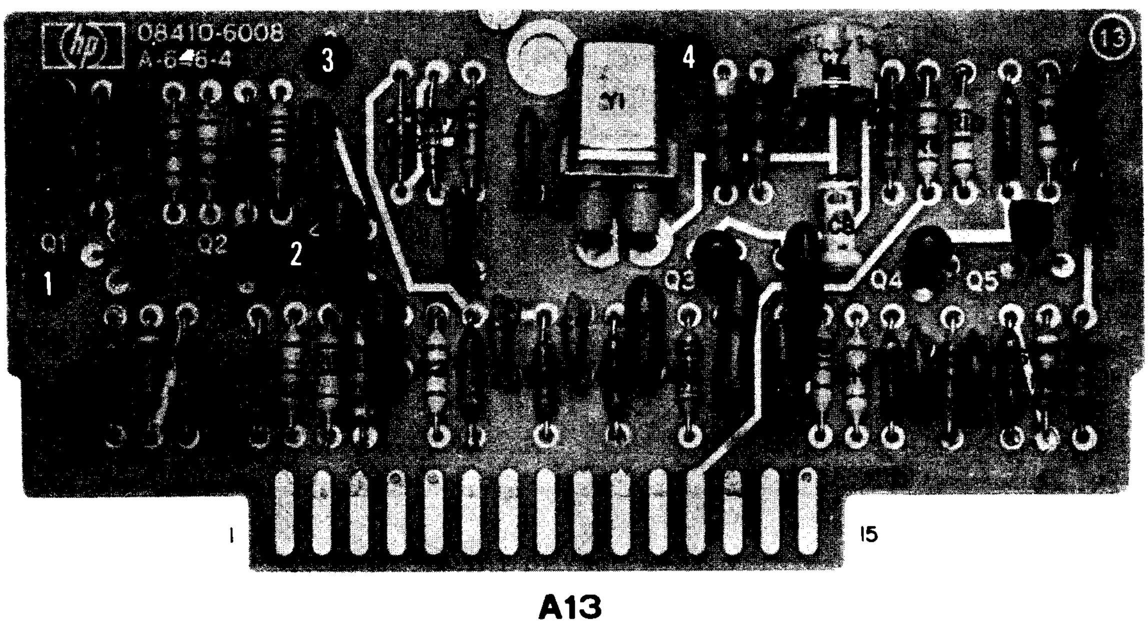
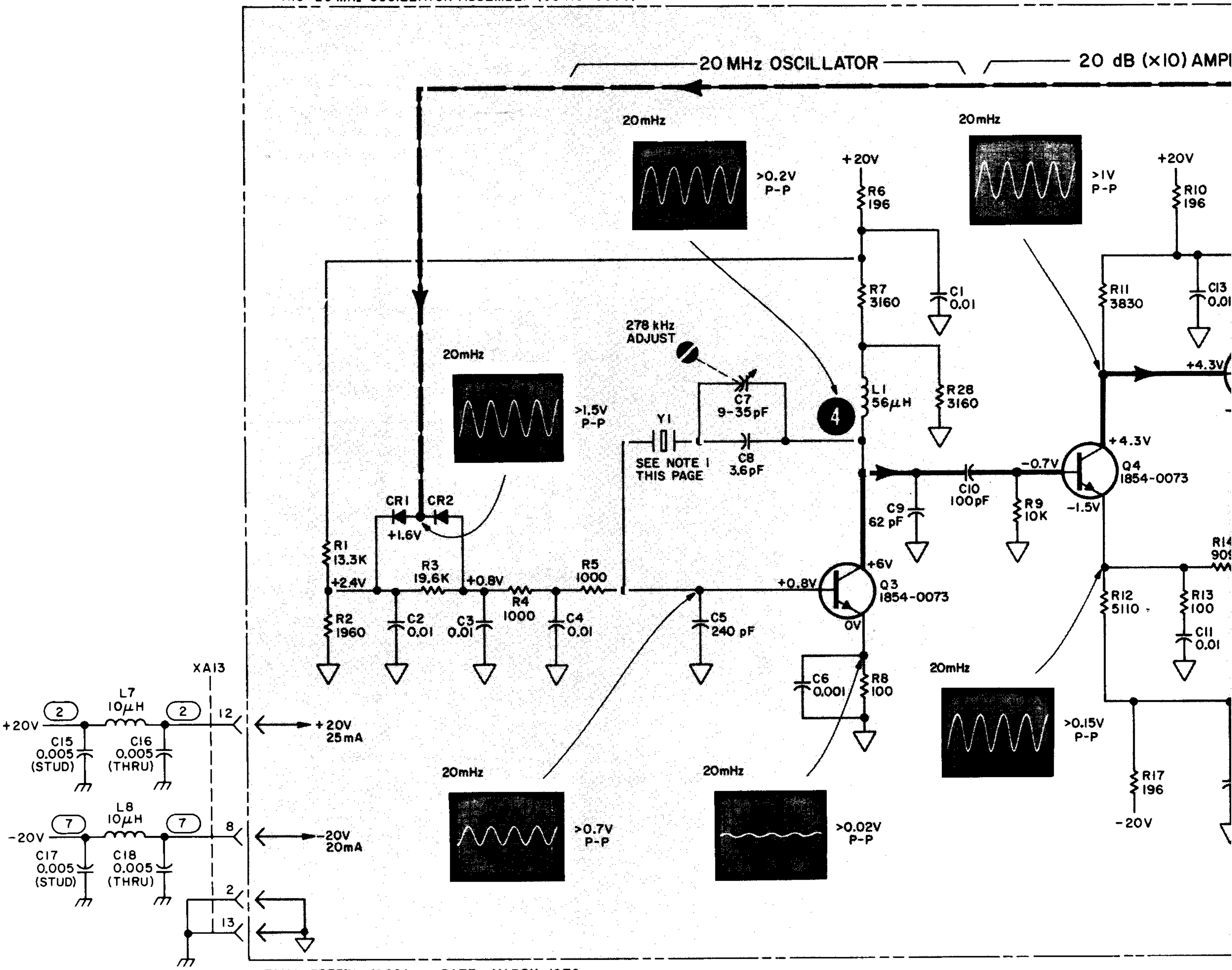
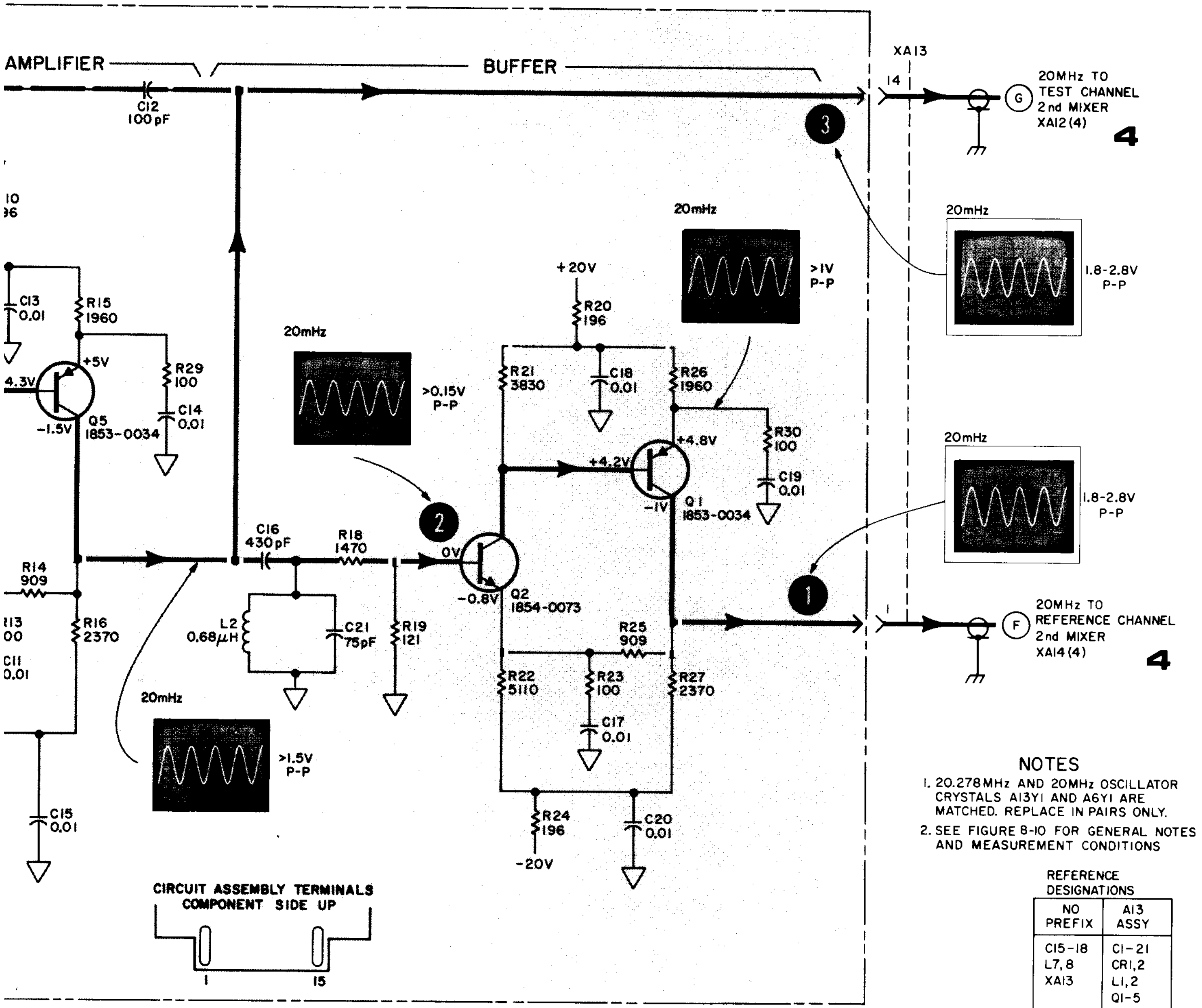


Figure 8-41. 8410B-A13 Parts Location

A13 20 MHz OSCILLATOR ASSEMBLY (08410-6008)



SERIAL PREFIX: 1902A DATE: MARCH 1979



NOTES

1. 20.278MHz AND 20MHz OSCILLATOR CRYSTALS A13Y1 AND A6Y1 ARE MATCHED. REPLACE IN PAIRS ONLY.
2. SEE FIGURE 8-10 FOR GENERAL NOTES AND MEASUREMENT CONDITIONS

REFERENCE DESIGNATIONS

NO PREFIX	A13 ASSY
C15-18 L7, 8 XA13	C1-21 CR1,2 L1,2 Q1-5 R1-30 Y1

6

8410B-A13

ALSO: 8410B-C15, C16, C17, C18, L7 AND L8.

Figure 8-42. 8410B-A13 Schematic Diagram

8410B AGC AMPLIFIER A15, CIRCUIT DESCRIPTION

20 dB AMPLIFIER

A15Q1 and A15Q2 comprise a feedback-pair amplifier. The approximate gain of the stage is the value of A15R5 divided by A15R4. A15Q3 is an emitter follower, providing (1) isolation between A15Q2 and peak detector A15CR1, and (2) low-impedance output to the peak detector circuit.

PEAK DETECTOR

A15CR1 and A15CR2 comprise a peak detector. A15CR1 passes the negative portion of the signal from A15Q3 to A15Q4. The peak negative signal applied to the base of A15Q4 is limited to −0.6 Vdc by A15CR2.

59 dB DC AMPLIFIER

A15Q4A and A15Q4B comprise a differential amplifier. Output at the collector of A15Q4A is determined by the difference between the input voltages at the bases of A15Q4A and A15Q4B. AGC signals from the differential amplifier pass through amplifier A15Q6 and emitter follower A15Q7 to the AGC controlled circuits, A12 and A14. The amplifier is stabilized by the feedback circuit formed by A15R24, A15R25, and A15C12. The feedback signal is applied to the base of A15-Q4B, holding the gain of the amplifier constant. A15R21 is selected ot obtain the desired gain through amplifiers A12 and A14. The value is selected so that 100 mV peak-to-peak input at A14TP4 in the Reference AGC Amplifier produces an output at A14TP1 of 190 to 250 mV peak to peak.

AGC MONITOR

A15Q8 forms a current amplifier for the REF CHANNEL LEVEL meter, M1. Changes in base bias applied to A15Q8 control current through the 0—1 mA meter, M1. An input of about +750 mVdc at A15TP4 produces a meter indication at M1 at the upper limit of the OPERATE range. An input of about +8 Vdc produces near zero meter indication.

A15C16 and A15L1 form a filter circuit between the TEST and REFERENCE automatic gain control circuits.

8410B AGC AMPLIFIER A15 TROUBLESHOOTING

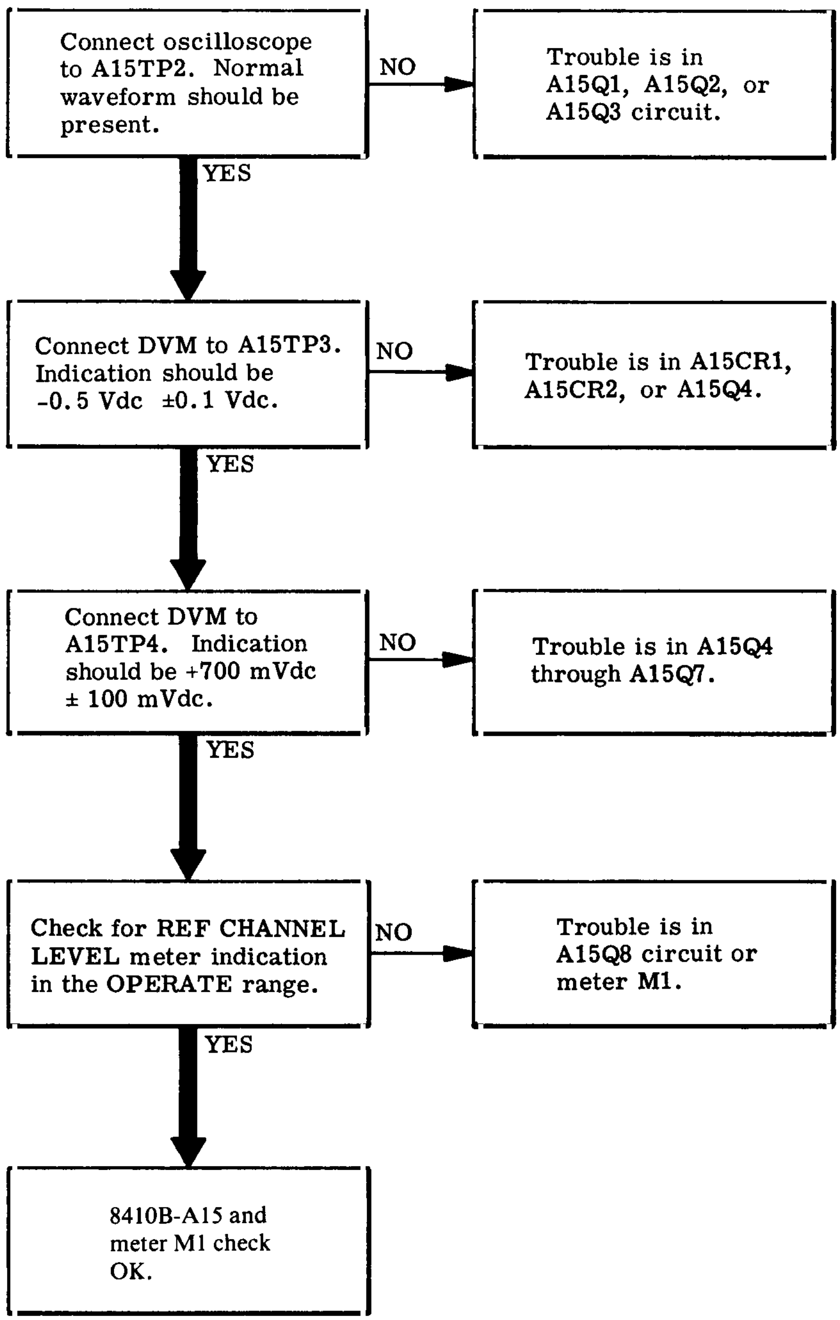


Figure 8-43. 8410B-A15 Troubleshooting

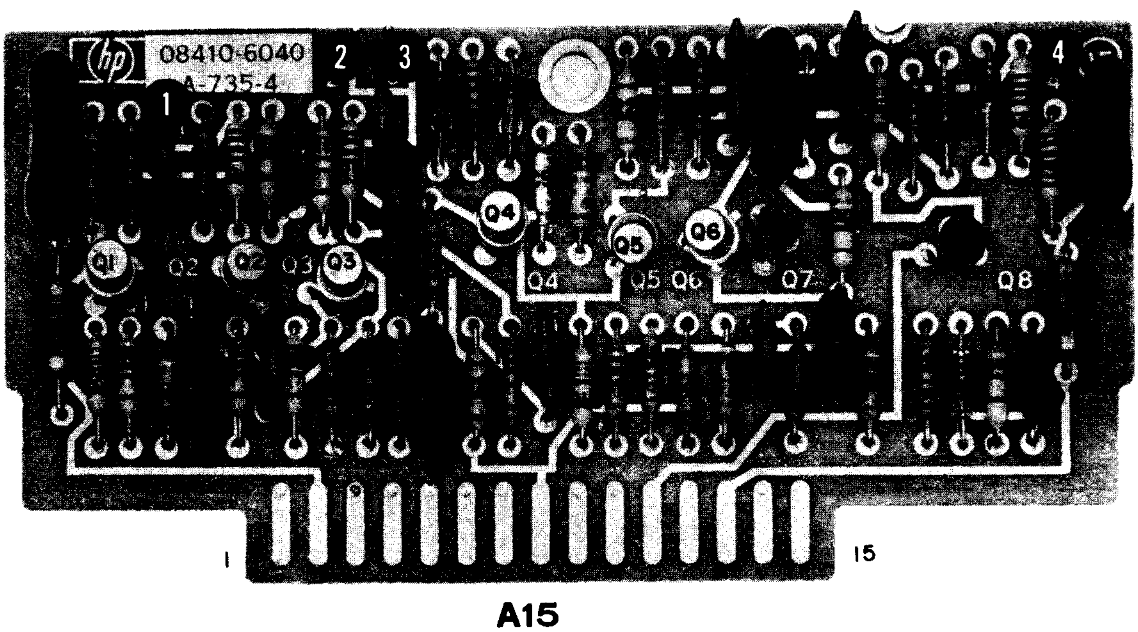
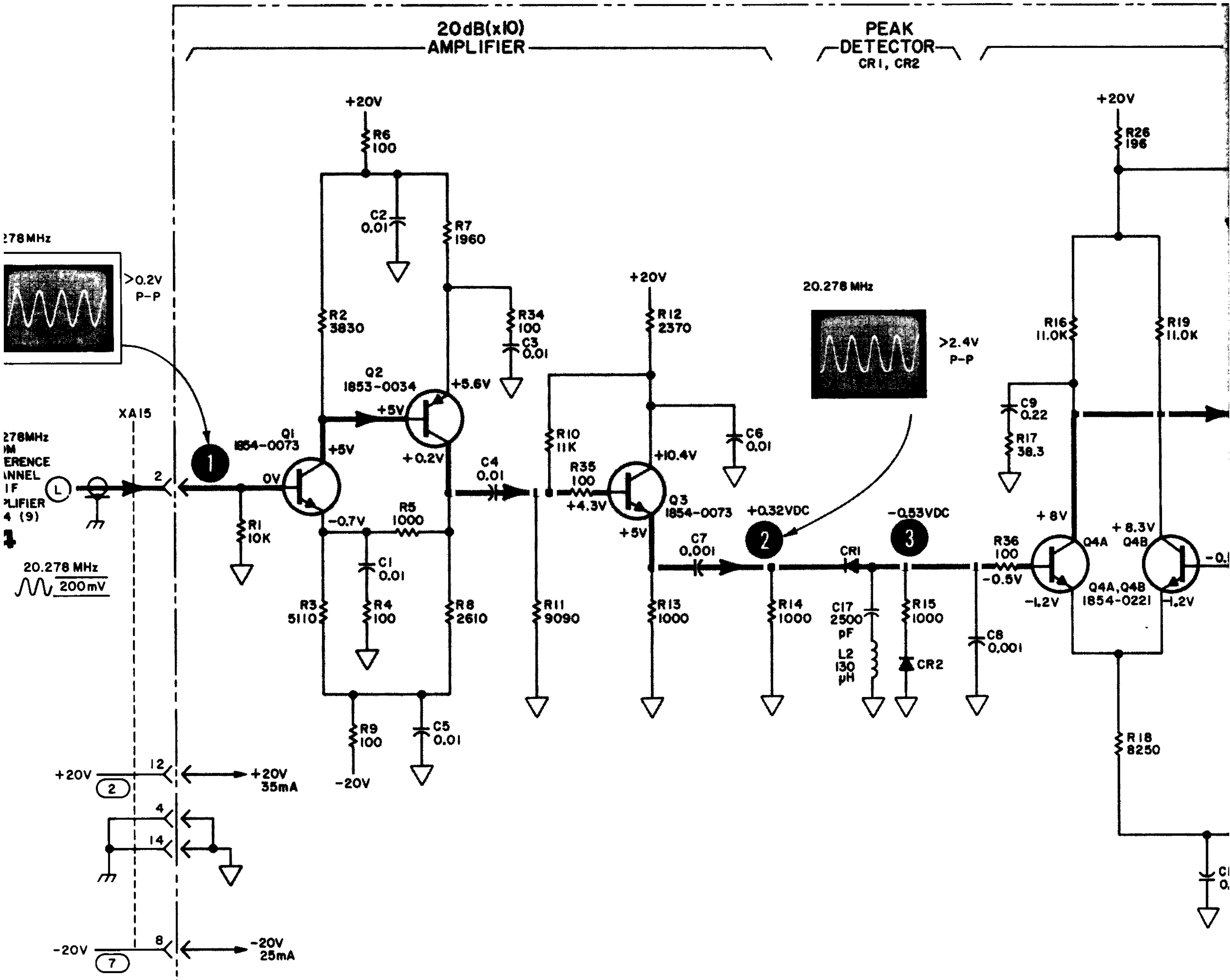
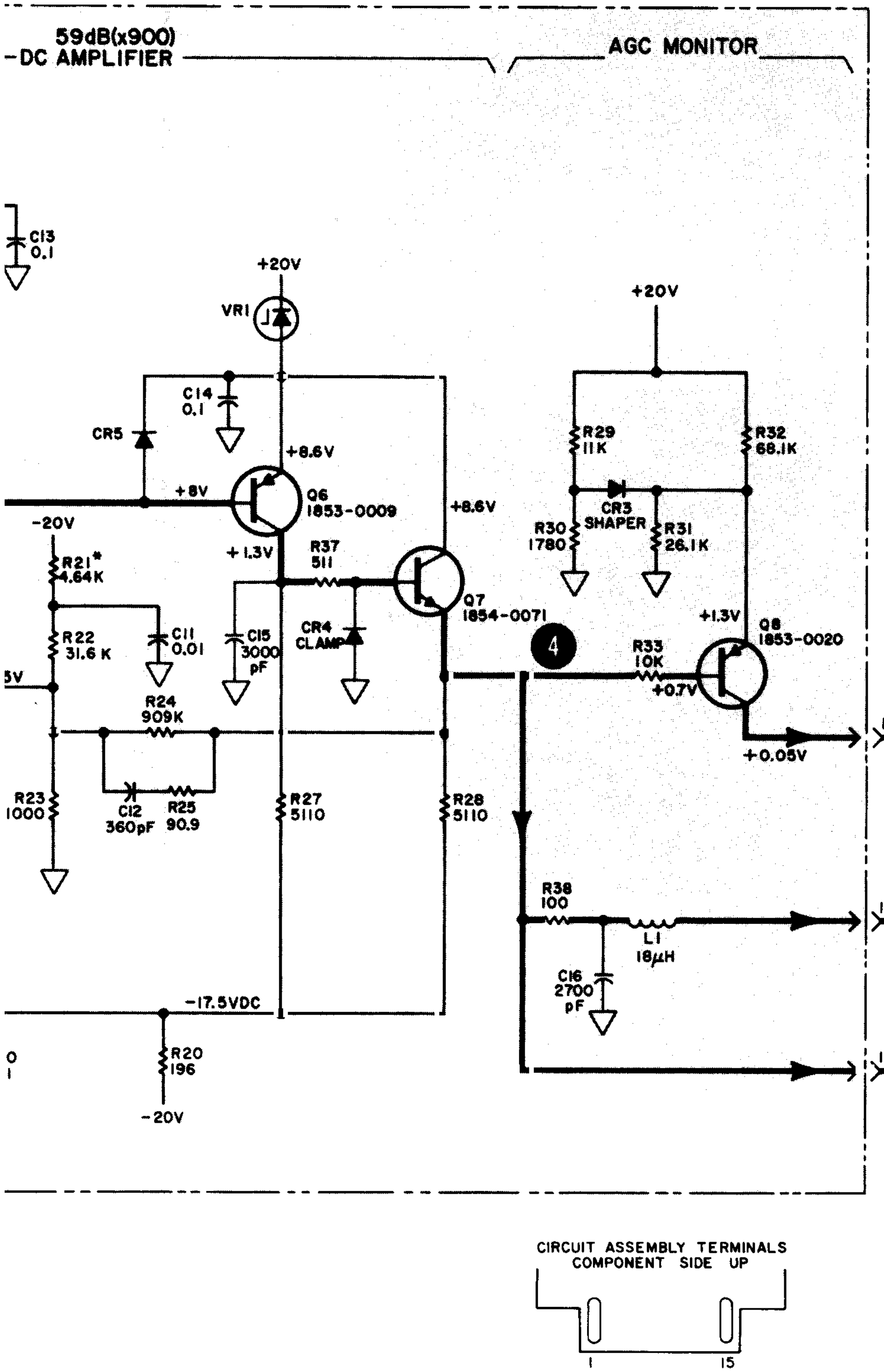


Figure 8-44. 8410B-A15 Parts Location

A15 AGC AMPLIFIER ASSEMBLY (08410-6040)



SERIAL PREFIX: 1902A DATE: MARCH 1979



REFERENCE DESIGNATIONS

NO PREFIX	A15 ASSY
C24 M1 XA15	C1-17 CR1-5 L1-2 Q1-4,6-8 R1-38 VR1

NOTES

1. SEE FIGURE 8-10 FOR GENERAL NOTES AND MEASUREMENT CONDITIONS.

7

8410B-A15
ALSO: 8410B-C24, AND M1

Figure 8-45. 8410B-A15 Schematic Diagram

8410B TEST CHANNEL SECOND IF AMPLIFIER A2, A3, AND A11, CIRCUIT DESCRIPTION

10 dB AMPLIFIER

The gain of A11Q1 is determined approximately by the value of A11R3 divided by A11R4. The value of A11R4 is selected so that a 200 mV peak-to-peak signal at A11TP1 will produce a 10V ±1V peak-to-peak signal at A11TP3.

BANDPASS FILTER

A11C4, A11C6, and A11L1 form a parallel- resonant 278-kHz circuit. The value of A11C14 is selected to tune the center frequency of the circuit to 278 kHz.

FEEDBACK PAIR AMPLIFIER

FET A11Q5 and A11Q6 form a feedback pair amplifier. The feedback path is from collector of A11Q6 through R23, R24, and C17 to ground. The gain can be determined approximately by the formula:

$$A_v = \left(\frac{A11R28}{A11R27 + A11R28}\right)\left(\frac{A11R23 + A11R24}{A11R24}\right)$$

FEEDBACK PAIR AMPLIFIER

A11Q3 and A11Q4 form a feedback-pair amplifier. The gain is approximately equal to the value of A11R14 plus A11R13 divided by A11R13.

AMPLITUDE TEST CHANNEL GAIN

AMPLITUDE TEST CHANNEL GAIN controls A2S1 and A3S1 provide 0 to 69 dB of attenuation to the 278-kHz signal in 1-dB steps.

A2S1 is a 0- to 9-dB attenuator consisting of five pi-type attenuator pads: one 1-dB, two 2-dB, and two 4-dB circuits. Switching combinations of these pads in series with the signal provide an attenuation range of 0 to 9 dB in 1-dB steps.

A3S1 is a 0-to 60-dB attenuator consisting of six pi-type attenuator pads: three 10-dB and three 20-dB circuits. Switching combinations of these pads in series with the signal provides a range of 0 to 60 dB in 10-dB steps.

8410B TEST CHANNEL SECOND IF AMPLIFIER A11 TROUBLESHOOTING

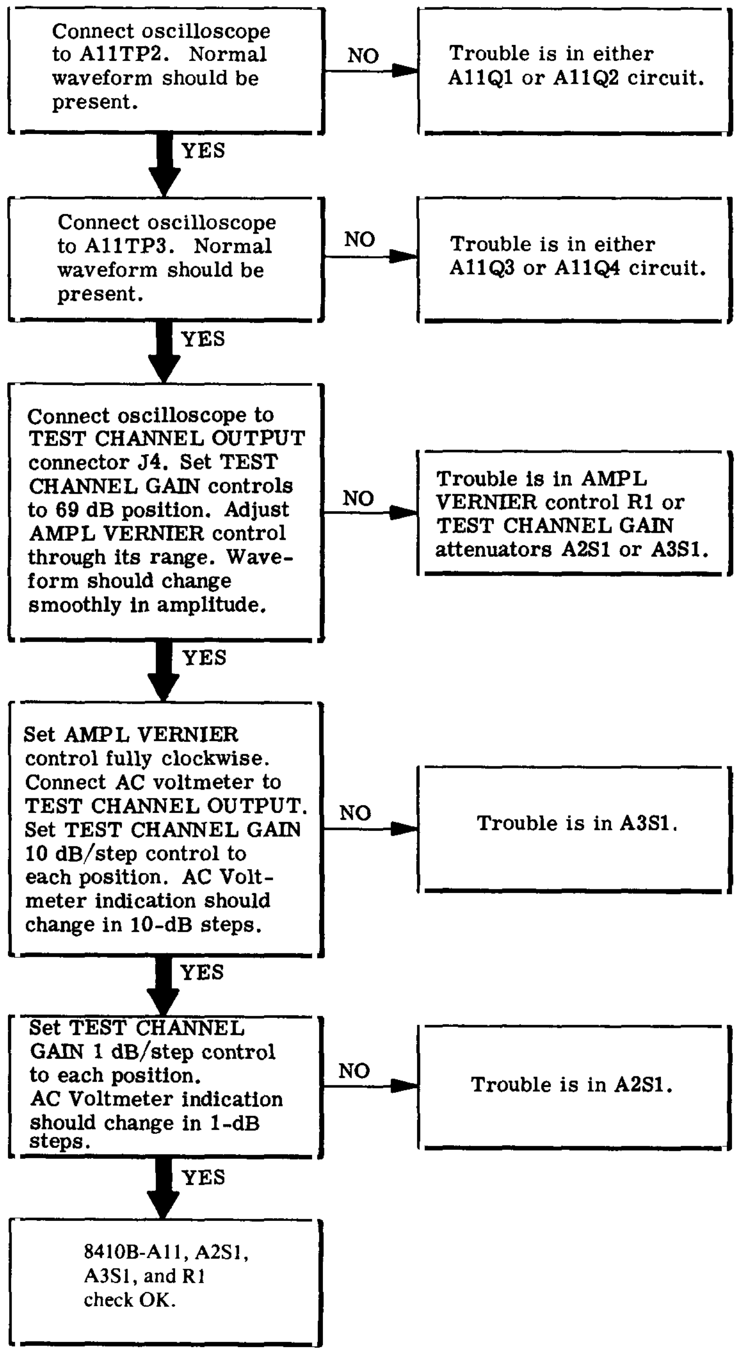
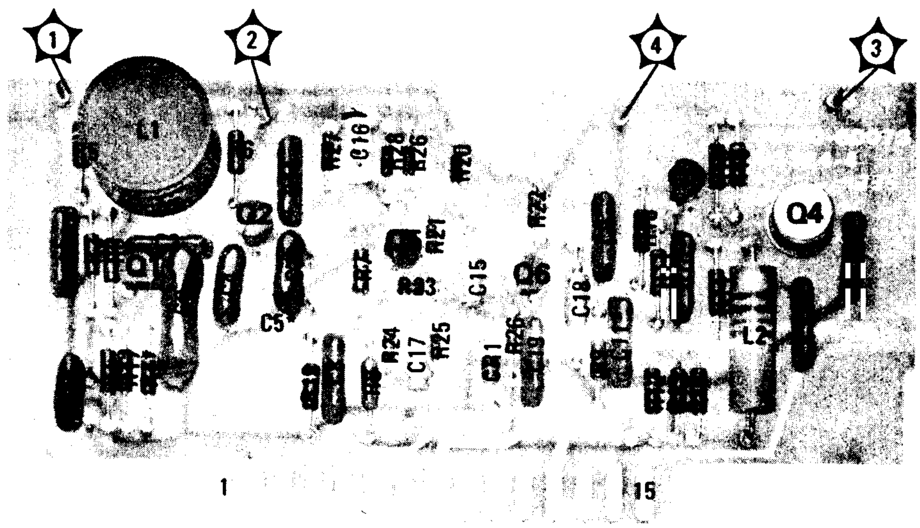


Figure 8-46. 8410B-A11 Troubleshooting

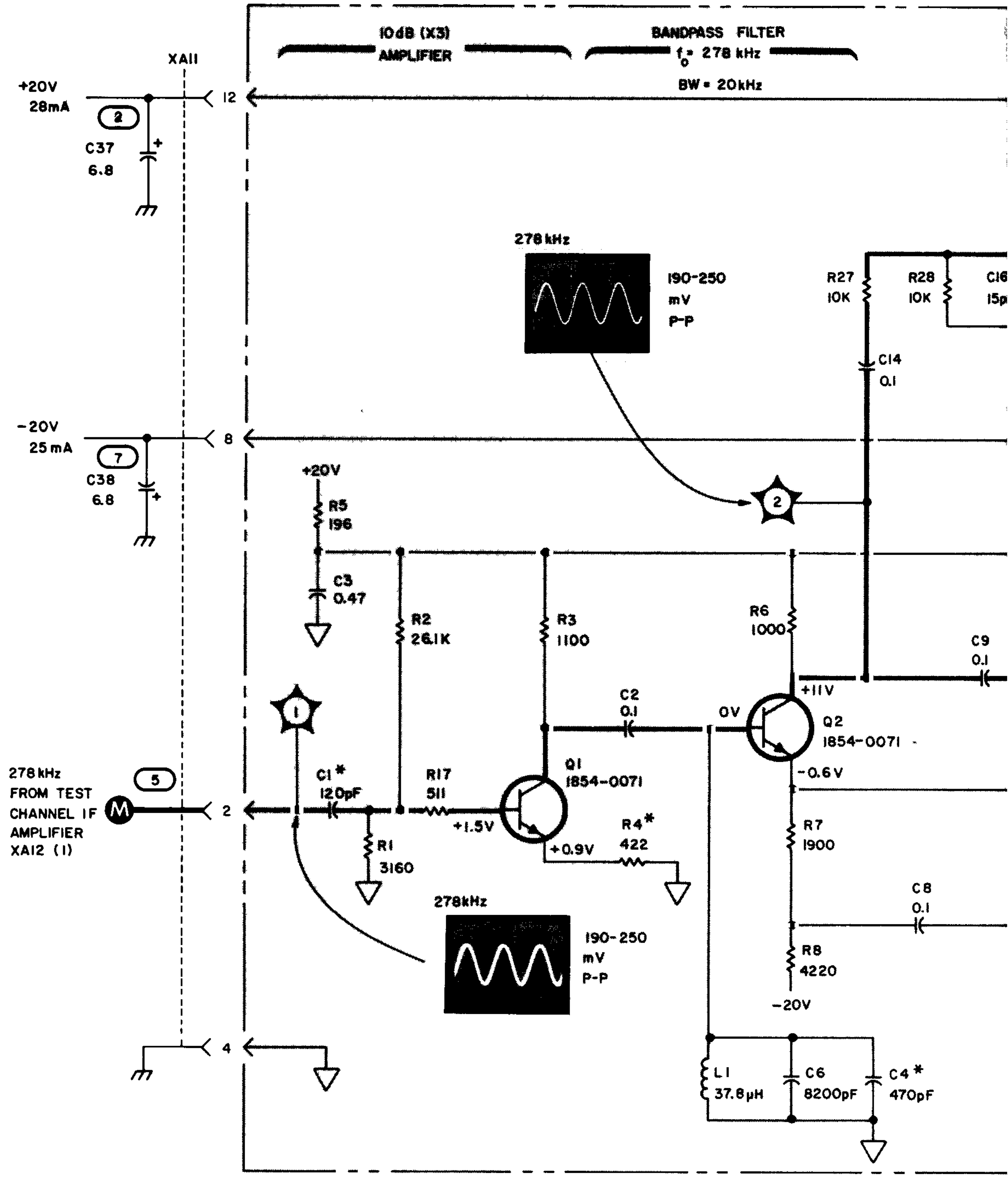
A11



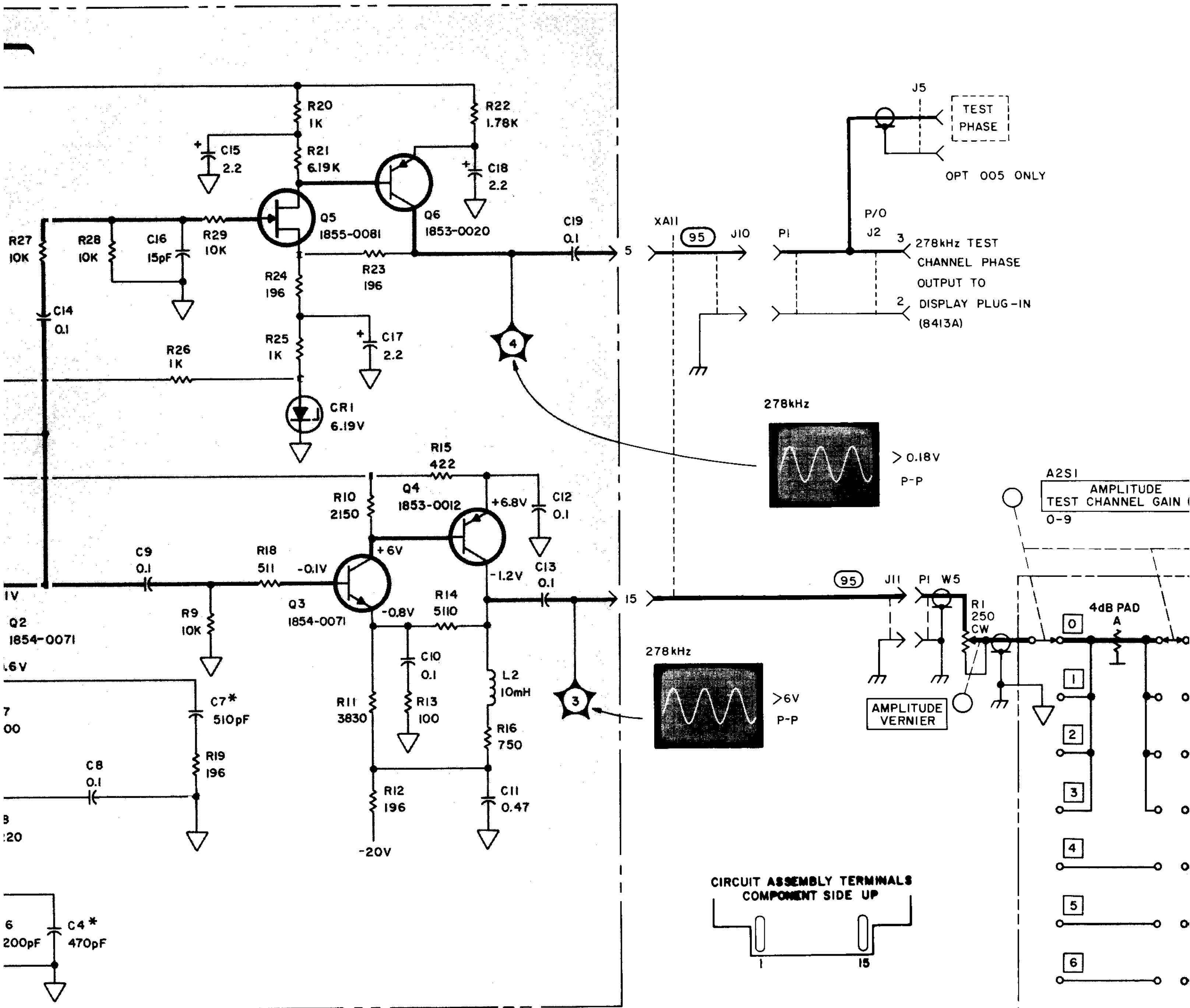
* FACTORY SELECTED VALUE.
PART MAY BE OMITTED.

Figure 8-47. 8410B-A11 Parts Location

A11 AMPLITUDE ATTENUATOR AMPLIFIER ASSEMBLY (08410-60073)



SERIAL PREFIX: 1902A DATE: MARCH 1979



NOTES

1. SEE FIGURE 8-10 FOR GENERAL NOTES AND MEASUREMENT CONDITIONS

REFERENCE DESIGNATIONS

NO PREFIX	A2 ASSY	A3 ASSY	A11 ASSY
C37, C38 J2,4,10,11 R1 W4-6,10 XA11	S1 R1-15	C1 L1 S1 R1-19	C1-13 L1, 2 Q1-4 R1-19

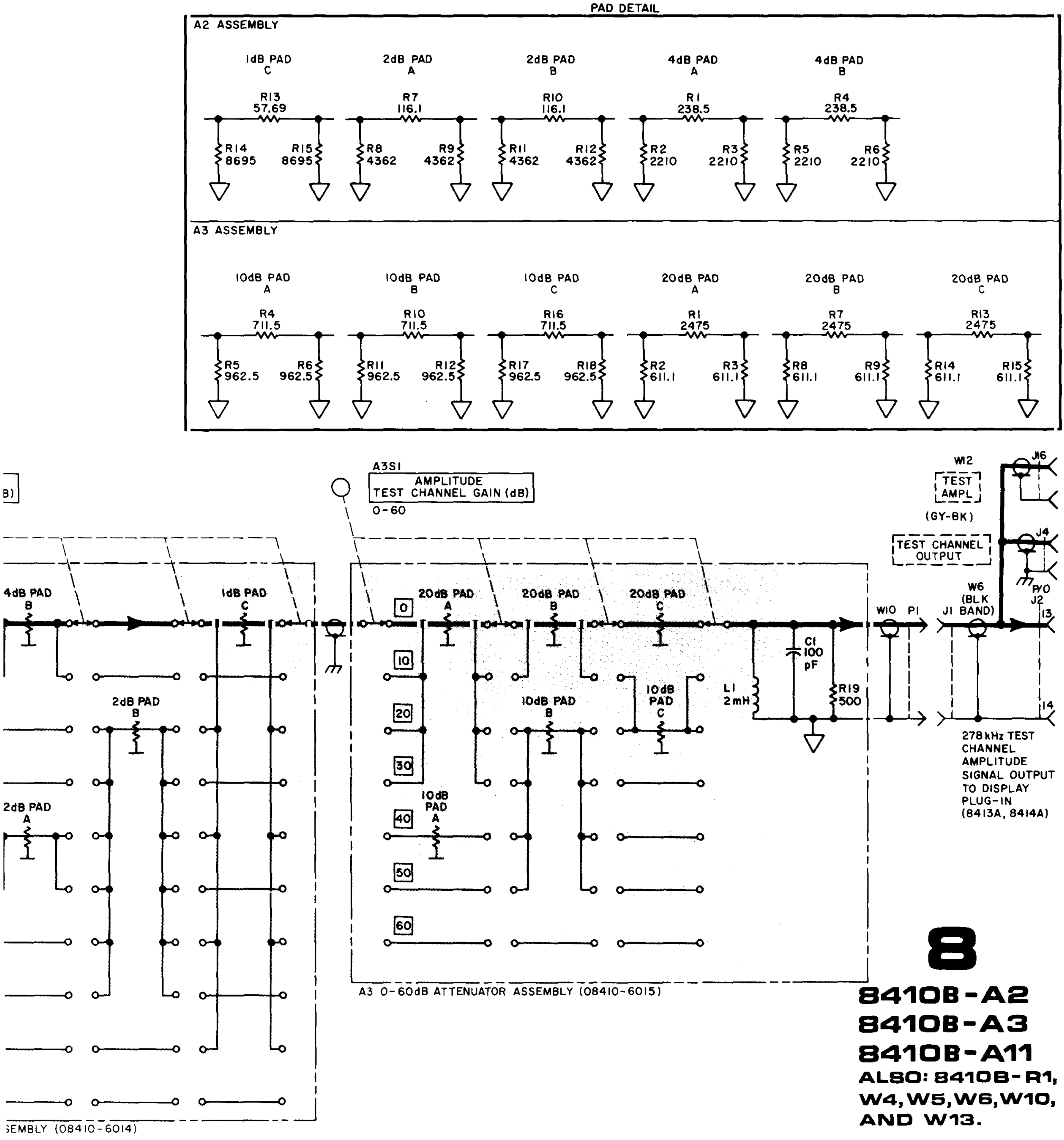


Figure 8-48. 8410B-A11 Schematic Diagram

8410B 20.278 MHz IF AMPLIFIER A4, CIRCUIT DESCRIPTION

20 dB AMPLIFIER

A4Q3 through A4Q6 compose two feedback-pair amplifiers. The approximate gain of the A4Q3—A4Q4 pair is determined by the ratio of A4R16 divided by A4R15. The approximate gain of the A4Q5—A4Q6 pair is determined by the ratio of A4R4 divided by A4R3.

26 dB LIMITER

A4Q1 and A4Q2 comprise a differential amplifier that acts as a limiter to high-signal level inputs. With a 20.278- MHz input sine-wave signal in the range of 1 to 10 volts peak to peak, the output squarewave signal will be about 2 volts peak to peak.

8410B — 20.278 MHZ IF AMPLIFIER A4 TROUBLESHOOTING

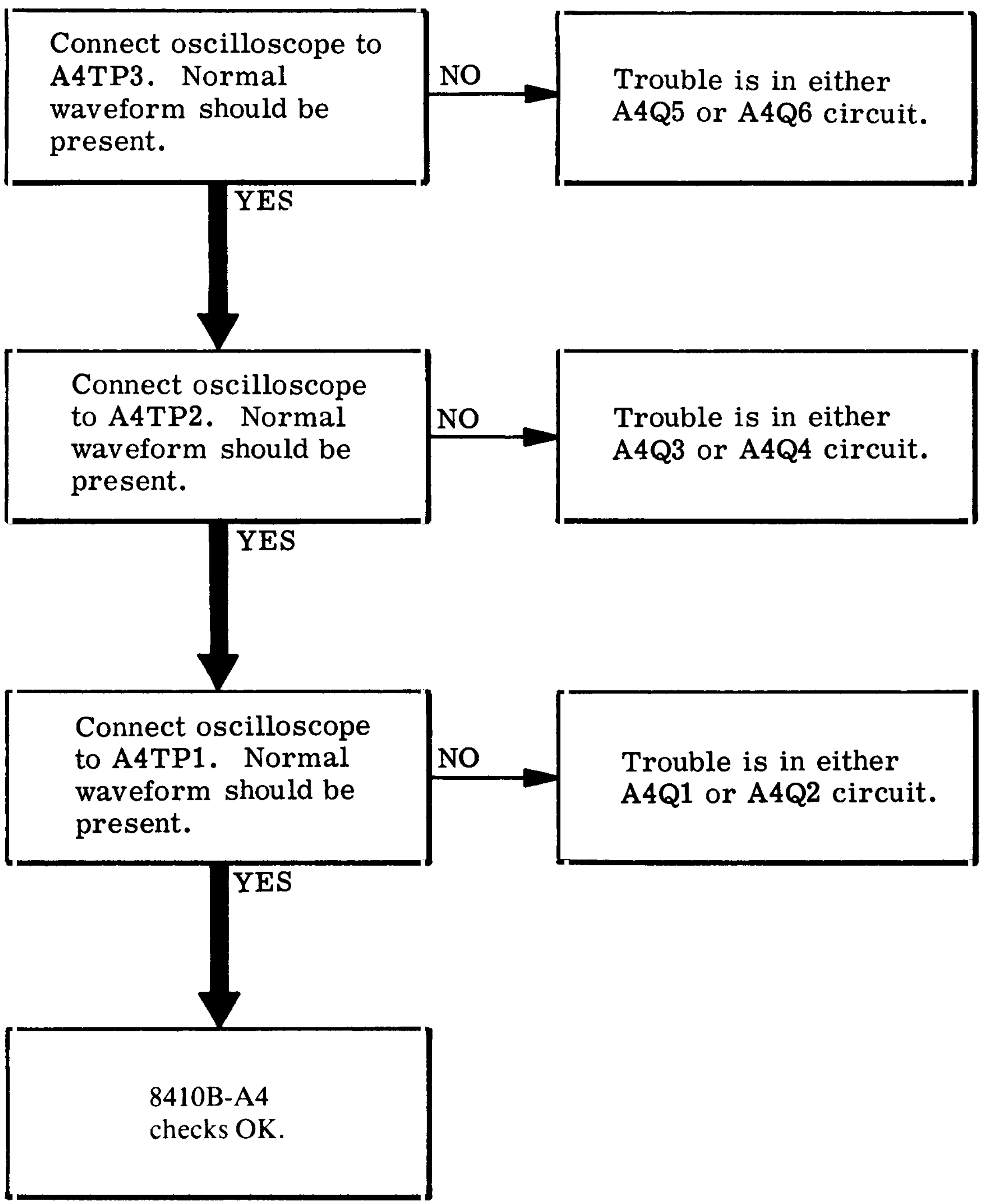


Figure 8-49. 8410B-A4 Troubleshooting

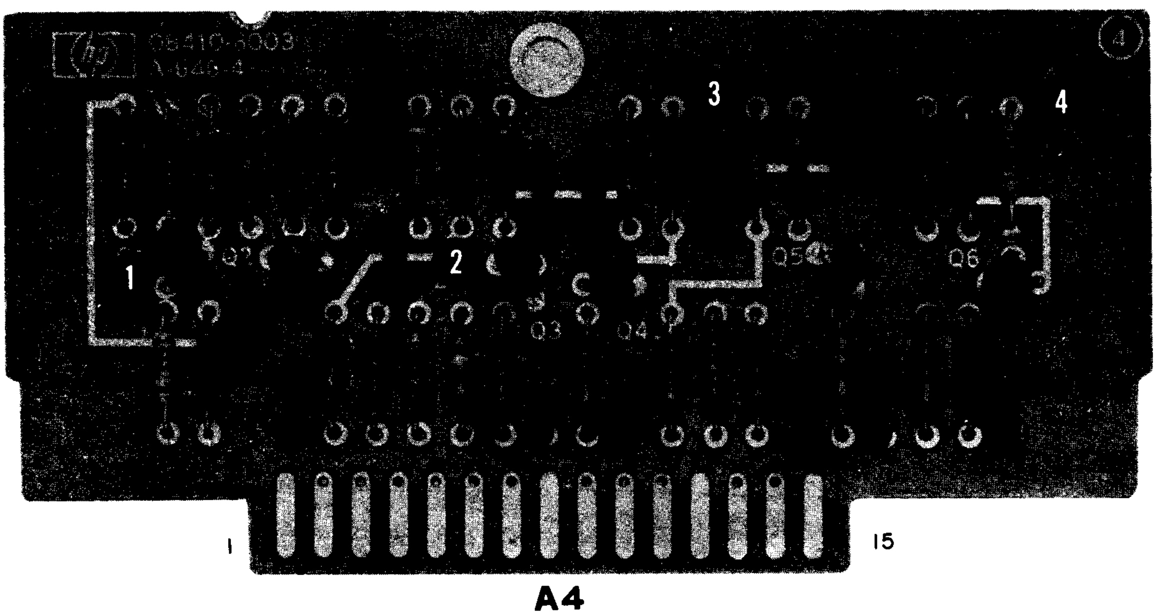
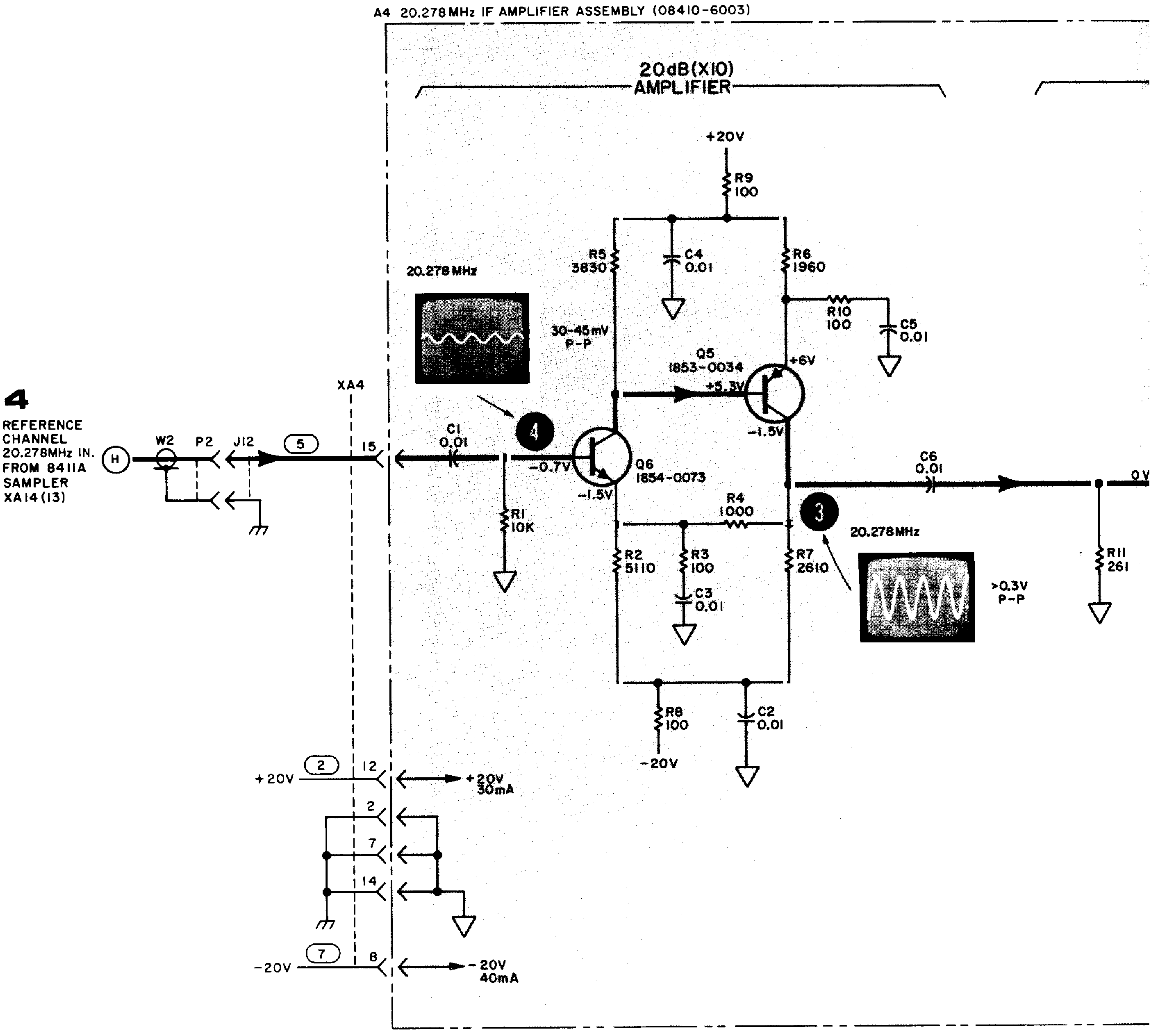


Figure 8-50. 8410B-A4 Parts Location



SERIAL PREFIX: 1902A DATE: MARCH 1979

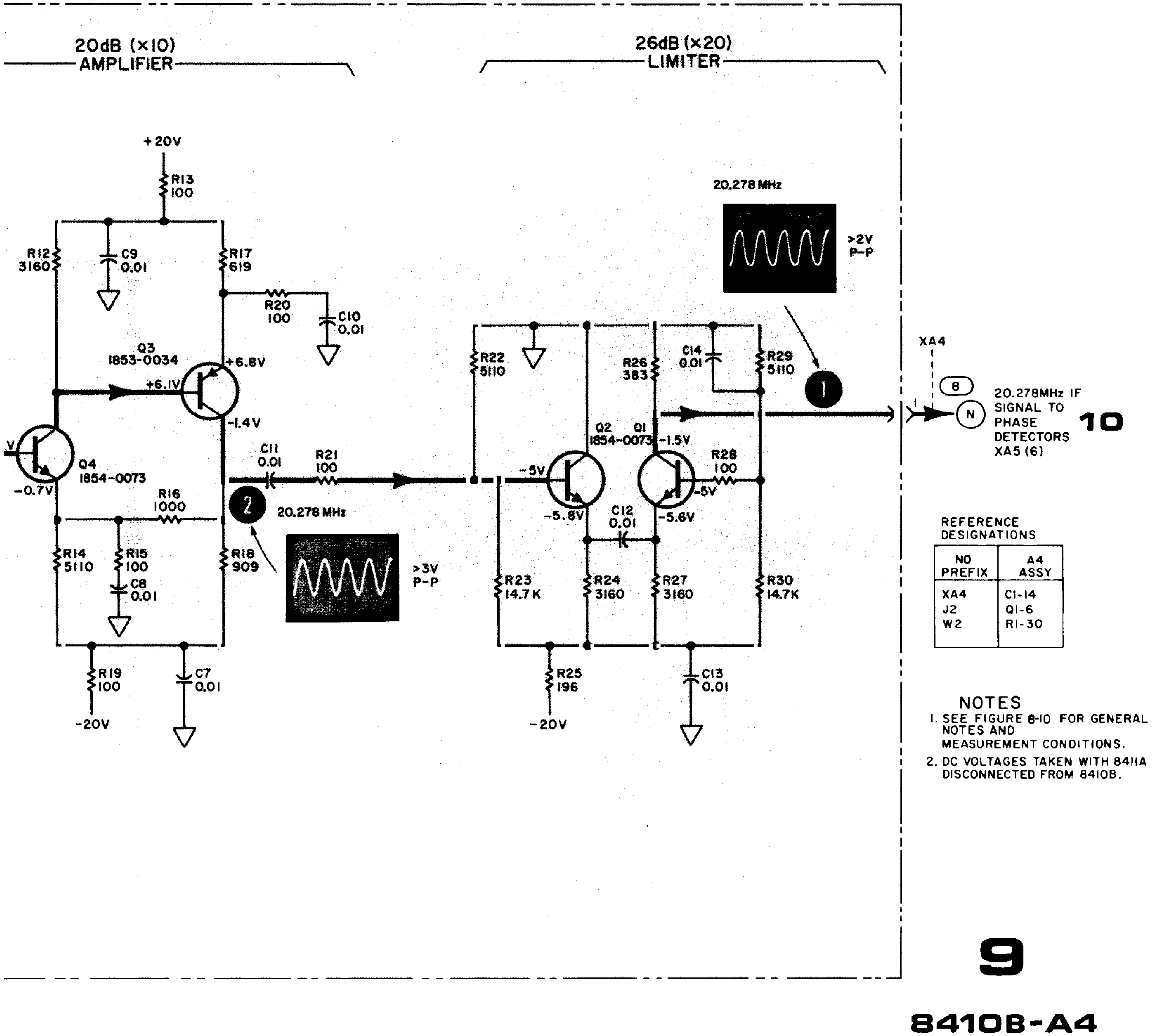


Figure 8-51. 8410B-A4 Schematic Diagram

8410B PHASE DETECTOR A5, CIRCUIT DESCRIPTION

BANDPASS FILTER

A bandpass filter consisting of A5C2, A5C3, A5L2, and A5L3 resonates at 20.278 MHz, with a bandwidth of about 10 MHz.

PHASE DETECTOR DRIVER

The 20.278-MHz signal from the reference oscillator (A6) is applied to the base of A5Q4. Because of the high-amplitude input signal, the differential amplifier, A5Q4—A5Q5, acts as a limiter to the input sine wave, producing two square-wave outputs, 180 degrees apart. The two square-wave signals from the differential amplifier are used to gate phase detectors A and B. Constant current source A5Q6 allows the differential amplifier to turn on and off at fast rise times to produce a well squared output waveform.

+90° PHASE SHIFTER

A5Q3, A5R13, A5C6, and A5L4 produce a +90-degree phase shift in the 20.278-MHz signal before it is applied to phase detector B. Gain through the stage is approximately one.

PHASE DETECTOR A

Phase detector A consists of A5CR1 through A5CR4. The square-wave outputs from A5Q4 and A5Q5 are coupled through A5C10 and A5C11, gating phase detector A. The voltage level of the input signal during the gate time causes conduction through A5CR1 and A5CR2, developing a voltage across A5R25 and A5R26. The junction of A5CR3 and A5CR4 forms a summing point. When the positive voltage at A5R25 equals the negative voltage at A5R26, the summing point is zero volts. As the phase relationship changes between the input signal at A5TP2 and the reference signal at A5TP4 and A5TP5, the summing point voltage changes to either a positive or a negative voltage. The summing point voltage is applied as a phase-error signal through emitter follower A5Q1 and FREQ RANGE switch A1 to the input of the lock-mode switch in A7.

PHASE DETECTOR B

Phase detector B consists of A5CR5 through A5CR8. The square-wave outputs from A5Q4 and A5Q5 are coupled through A5C12 and A5C13, gating phase detector B. The voltage level of the input signal during the gate time develops a voltage across A5R27 and A5R28. This voltage is summed through A5CR7 and A5CR8 and is transmitted as a phase-error signal through emitter follower A5Q2 to the search disable switch in A8. Due to the 90-degree phase difference between the signal inputs to the detectors, dc output voltages from the two phase detectors differ in amplitude and polarity. During normal phase-locked conditions, the output of detector B will be a negative dc voltage.

8410B 20.278 MHz OSCILLATOR A6, CIRCUIT DESCRIPTION

LOW PASS FILTER AND PEAK DETECTOR

A6C11, A6CR1, and A6CR2, together with the associated resistor-capacitor network, form a negative feedback circuit which maintains a constant-amplitude oscillator signal to the phase detectors. Feedback pulses from A6C11 are detected by A6CR1 and A6CR2 and develop a dc signal across A6R3. This changes the dc bias at A6Q1 base, depending on feedback amplitude. The signal at A6TP2 stabilizes with constant output at about 1.8 to 2.3 volts peak to peak.

20.278 MHz OSCILLATOR

A6Q1 and A6Y1 form a 20.278-MHz crystal oscillator circuit. The feedback loop is formed by A6C6 and A6Y1.

20 dB AMPLIFIER

A6Q2 and A6Q3 compose a feedback-pair amplifier. The approximate gain of the circuit is determined by the ratio of A6R12 divided by A6R11.

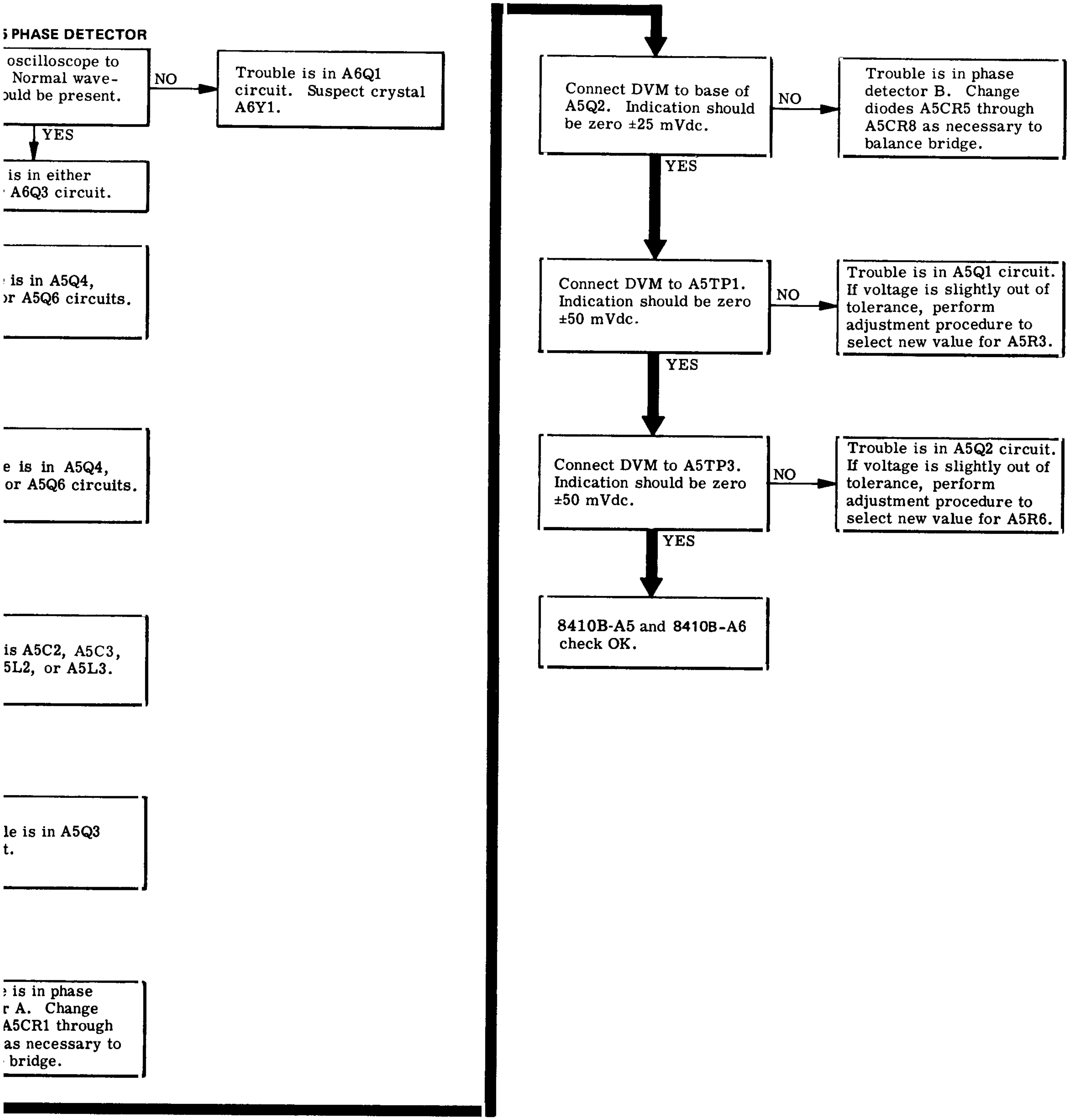
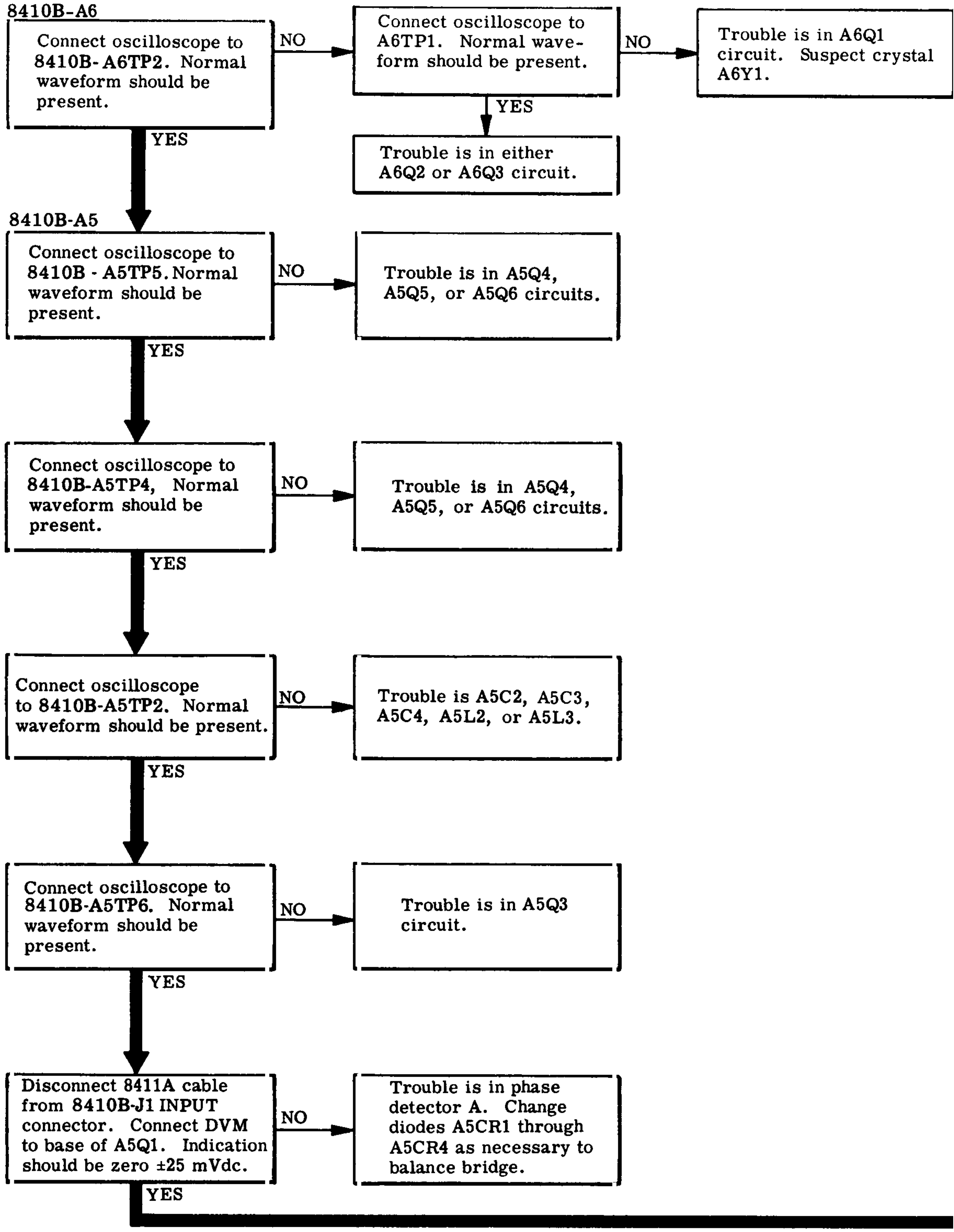
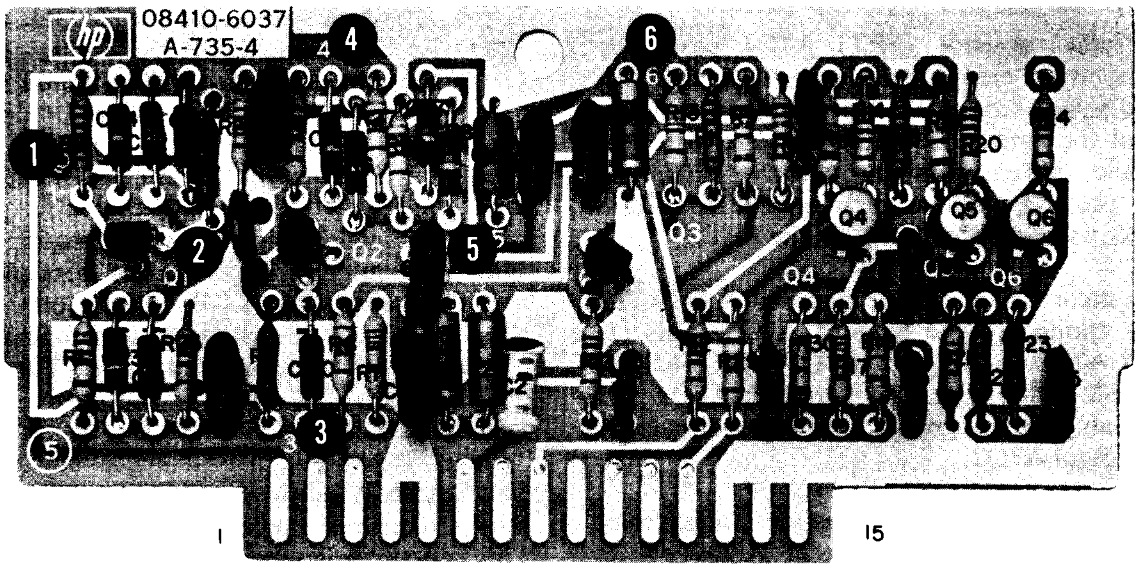


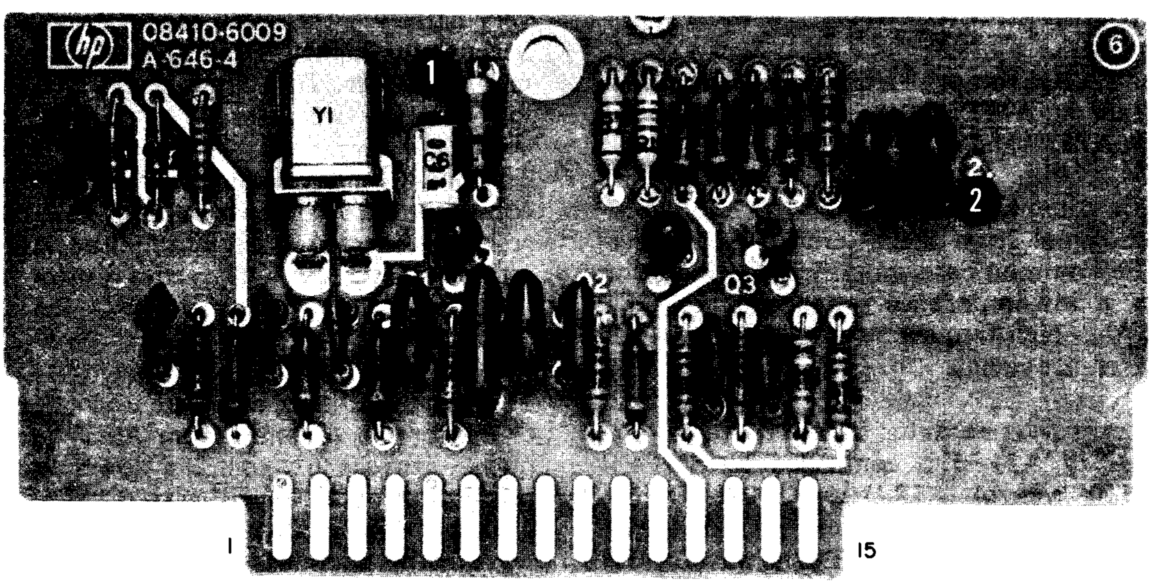
Figure 8-52. 8410B-A5 and A6 Troubleshooting

8410B–A6 20.278 MHz OSCILLATOR AND 8410B–A5 PHASE DETECTOR





A5



A6

Figure 8-53. 8410B-A5 and A6 Parts Location

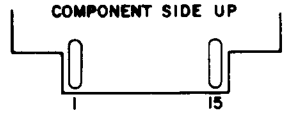
REFERENCE DESIGNATIONS

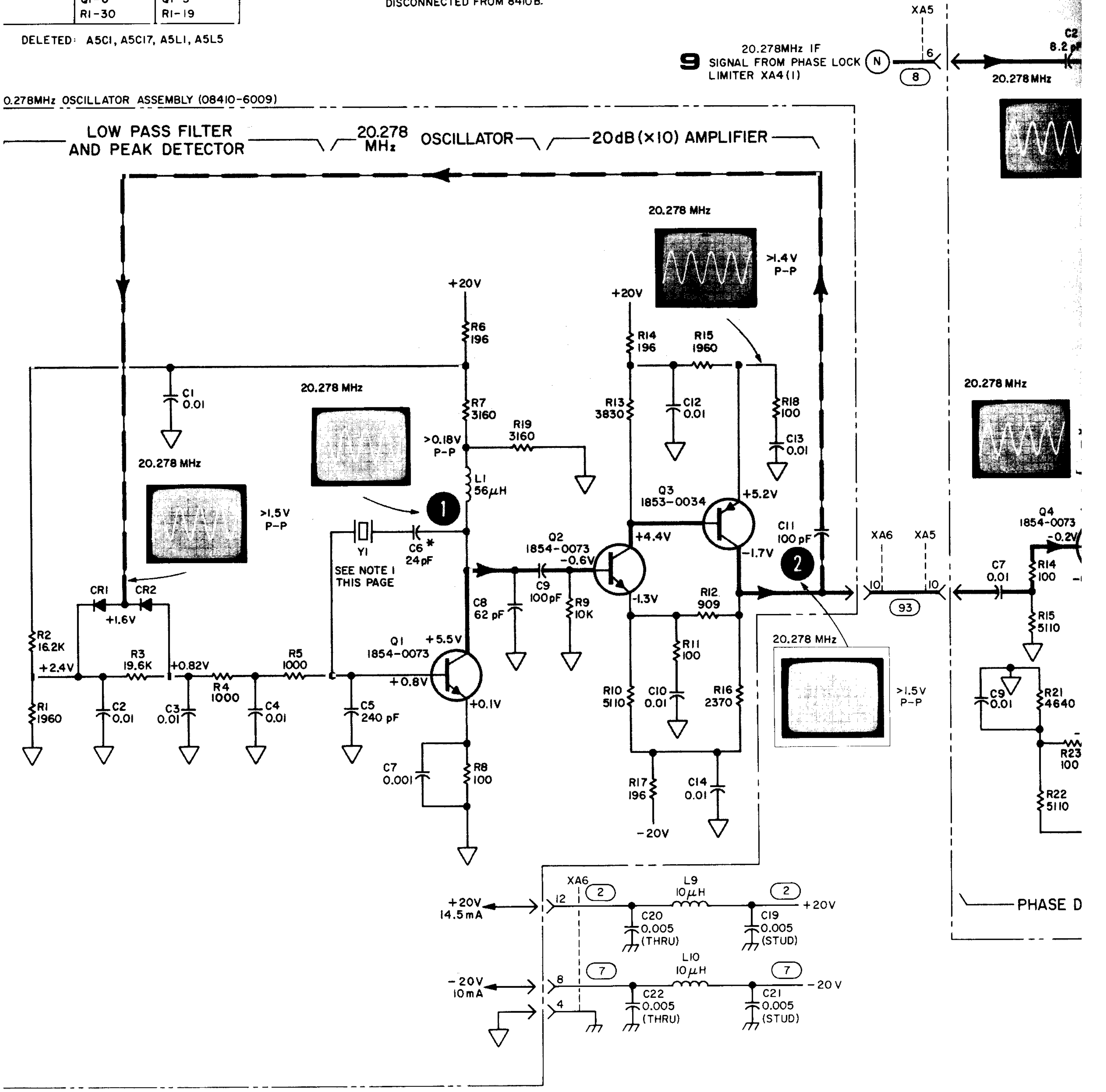
NO PREFIX	A5 ASSY	A6 ASSY
:19-22,34	C2-16	C1-14
.9,10	CR1-10	CR1, 2
:A5,6	L2-4	L1
	Q1-6	Q1-3
	R1-30	R1-19

DELETED: A5C1, A5C17, A5L1, A5L5

NOTES

1. 20 MHz AND 20.278 MHz OSCILLATOR CRYSTALS A6Y1 AND A13Y1 ARE MATCHED. REPLACE IN PAIRS ONLY.
2. SEE FIGURE 8-10 FOR GENERAL NOTES AND MEASUREMENT CONDITIONS
3. A5 DC VOLTAGES TAKEN WITH 8411A DISCONNECTED FROM 8410B.





SERIAL PREFIX: 1902A DATE: MARCH 1979

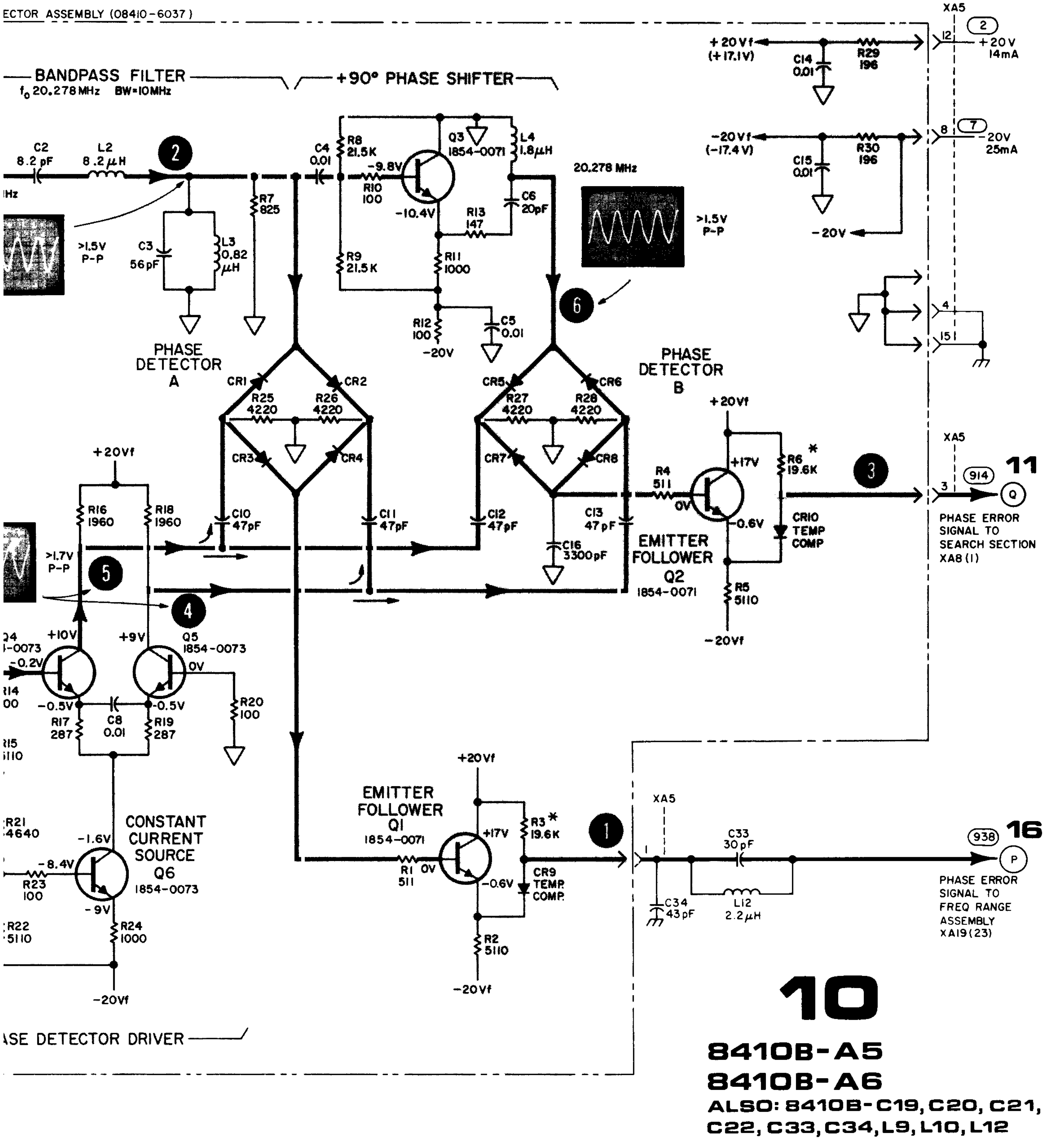


Figure 8-54. 8410B-A5 and A6 Schematic Diagram

8410B VTO DC AMPLIFIER A7, CIRCUIT DESCRIPTION

LOCK MODE SWITCH

Field effect transistor (FET) A7Q4 passes or blocks the phase-error signal from A5 and Search Initialize signal from A9, depending on the bias voltage at the gate (G). A negative gate-to-source bias blocks current flow through the FET, and zero or positive voltage between the gate and source allows signal flow through the FET.

When an incorrect lock mode is sensed, a +19 Vdc signal is applied to the base of A7Q3. This (1) turns off A7Q3, biasing off A7Q4, and breaking the phase-lock loop; and (2) turns on A7Q1 and A7Q2, clamping to ground the base circuit of A7Q6 through A7Q2.

When the phase-lock loop looses lock, a positive-going pulse from the collector of A8Q9 passes through A7C1 to the bases of A7Q1 and A7Q3, causing A7Q1 to turn on and A7Q3 to turn off. This turns A7Q2 on and turns A7Q4 off. The effect is to ground A7Q6 base, establishing a center frequency for the VTO search, depending on the setting of the SWEEP STABILITY control.

18 dB DC AMPLIFIER

A7Q5 and A7Q6 comprise a differential amplifier. The output at A7TP5 is the difference between signals at A7TP3 and A7TP4.

A7Q7 is a common-base amplifier for the sweep-reference signal from the external sweep generator. The common-base amplifier configuration provides a low-impedance input circuit. A7C8 couples the high-frequency component of the sweep-reference signal.

A7Q8 comprises an emitter follower circuit. The dc voltage at A7TP6 is controlled by SWEEP STABILITY control, A1R27 and A1S1. During search mode, the search waveform rides on the dc level present at A7TP6. At A7TP6 the waveform is 2V peak to peak or greater with the FREC RANGE switch set at 0.1—0.25 GHz positio With the FREQ. RANGE switch set at 8—12. GHz, the waveform is about 20 mV peak to peak.

The SWEEP STABILITY control A1R27 contro the dc reference level at A7TP6. During searc mode this control selects the center frequency c the VTO capture range. In swept-frequency opera tion this control is adjusted for best phase loc over the entire band. A CW position on the contro supplies a fixed dc voltage of approximately 10. Vdc at A7TP6 that is applied to the VTO.

EXTERNAL INPUT SIGNALS

The Search Window Size line at connector pin 1 puts a fixed resistance from that line to ground This resistance is selected in A19 by the setting o front panel FREQ. RANGE GHz switch, A1S1 At the lower input RF frequencies, the selecte resistance is high, producing a high-amplitud search waveform in order to sweep a wide VT range. At the higher input RF frequencies, th selected resistance is lower, producing a low amplitude search waveform in order to produce very narrow VTO sweep range. This is necessar because the higher frequencies use a higher har monic number. This circuit limits the number o lock points to two or three.

The Gain Compensation and Phase Error signal a connector pin 1 comes from A19. In A19, a serie resistor is selected to set the amplitude of the phas error signal from A5. The series resistor is selecte by the setting of front panel FREQ. RANGE GH switch, A1S1.

The Search Initialize and Rate Reduction signal a connector pin 6 comes from A9. When the fre quency range is 0.11 to 0.2, a slower search rate i required to obtain lock due to the few harmonic available for locking. A positive going squar wave on this line starts the search cycle.

8410B SEARCH A8 CIRCUIT DESCRIPTION

LOCK MODE SENSOR

The correct phase-lock condition is obtained when the system locks to a VTO harmonic that is 20.278 MHz higher in frequency than the input RF signal from the signal source. If the phase-lock loop attempts to lock on a VTO harmonic below the input RF frequency, an incorrect lock mode is detected, and the search mode continues until a new lock point is found. This is accomplished as follows. The Break Lock signal from A8 or phase detector B in A5 produces a positive dc voltage which triggers Schmitt trigger A8Q1-A8Q2. The output of A8Q2 turns off A7Q3 which, in turn, turns off lock-mode switch A7Q4. This opens the phase-lock loop and allows the search sequence to continue until the proper VTO harmonic is found. Trigger and reset points for A8Q1-A8Q2 are adjusted by selecting the value of A8R2. The circuit should trigger and reset with input voltages in the range of 135 to 215 mV.

SEARCH DISABLE TRIGGER

When the phase-lock loop locks in the correct mode, phase detector B of A5 produces a negative signal which triggers and holds Schmitt trigger A8Q8-A8Q9. With A8Q9 turned off, A8Q10 turns on and clamps A8Q5 collector near ground, stopping the search signal generator from oscillating.

The value of resistor A8R39 is selected to ensure that the turn-on and reset potentials for A8Q8 are between −150 and −200 mVdc.

SEARCH SIGNAL GENERATOR

A8Q3—A8Q7 form the search-signal generator. A feedback loop from the output of A8Q6—A8Q7 passes through emitter follower A8Q3 and triggers Schmitt Trigger A8Q4—A8Q5, initiating another cycle of search signal. The output of the Schmitt Trigger is amplified by A8Q6—A8Q7. The sawtooth waveform is formed by the charging and discharging of A8C1. The output frequency at A8TP3 is about 250 Hz and is determined by the RC time constant of A8C1 and A8R27. When the system phase locks, the search signal is stopped by grounding the collector of A8Q5 through the conduction of A8Q10.

8410B SEARCH SIGNAL GENERATOR A8 AND
8410B VTO DC AMPLIFIER A7 TROUBLESHOOTING

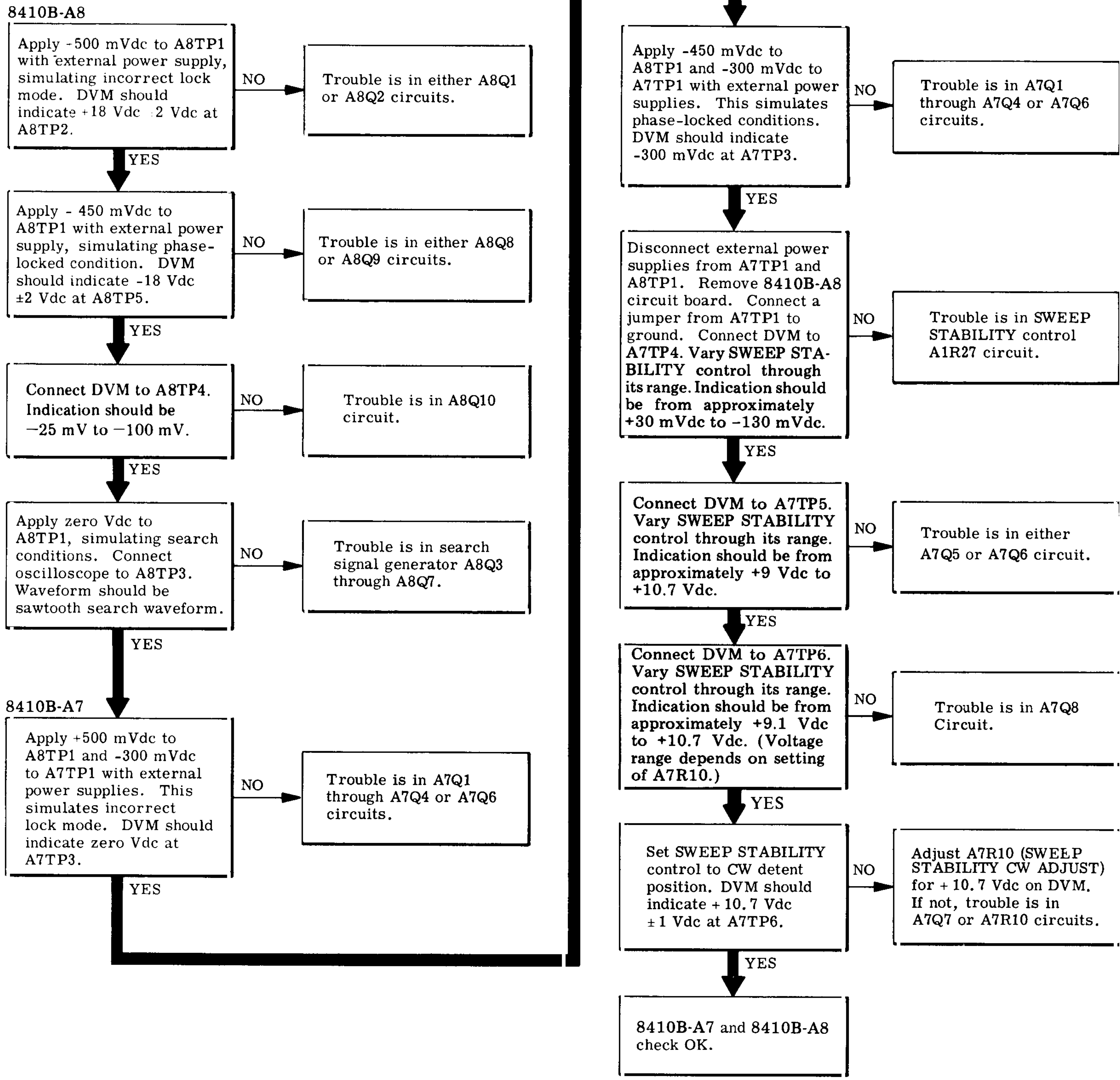
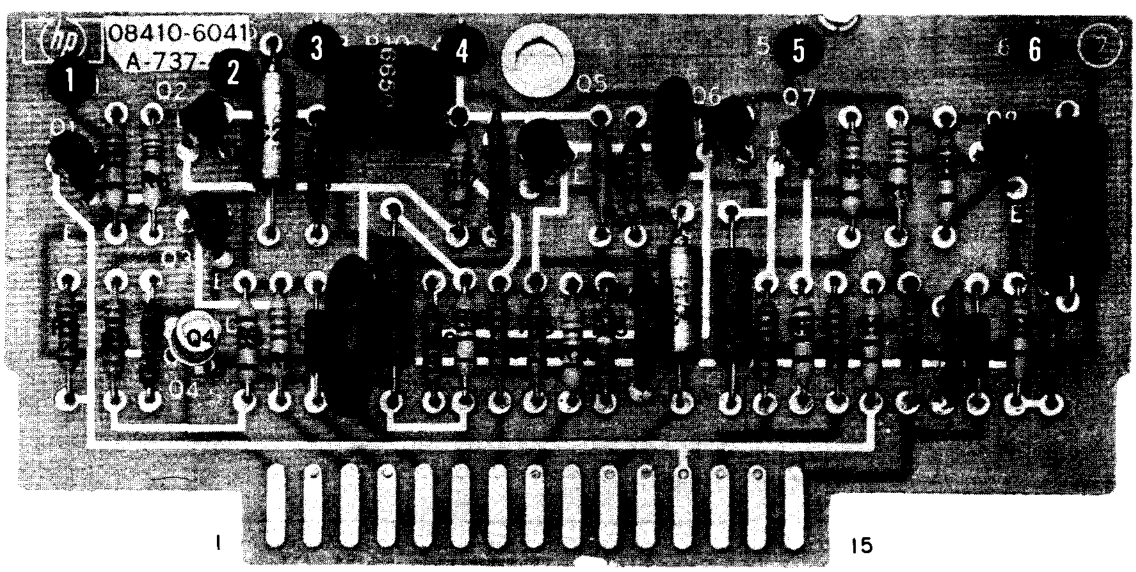
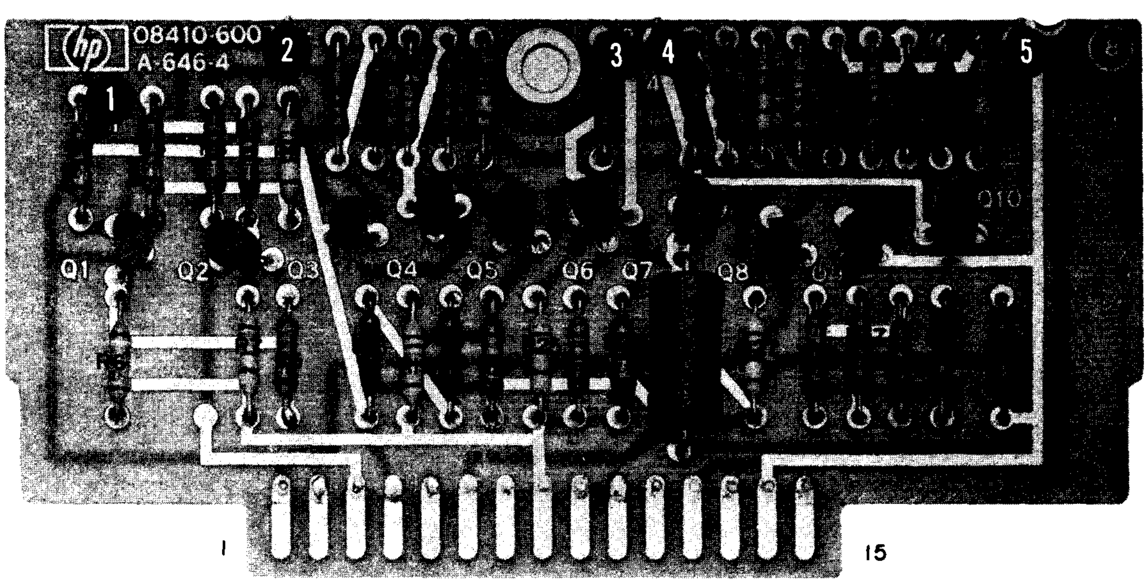


Figure 8-55. 8410B-A7 and A8 Troubleshooting

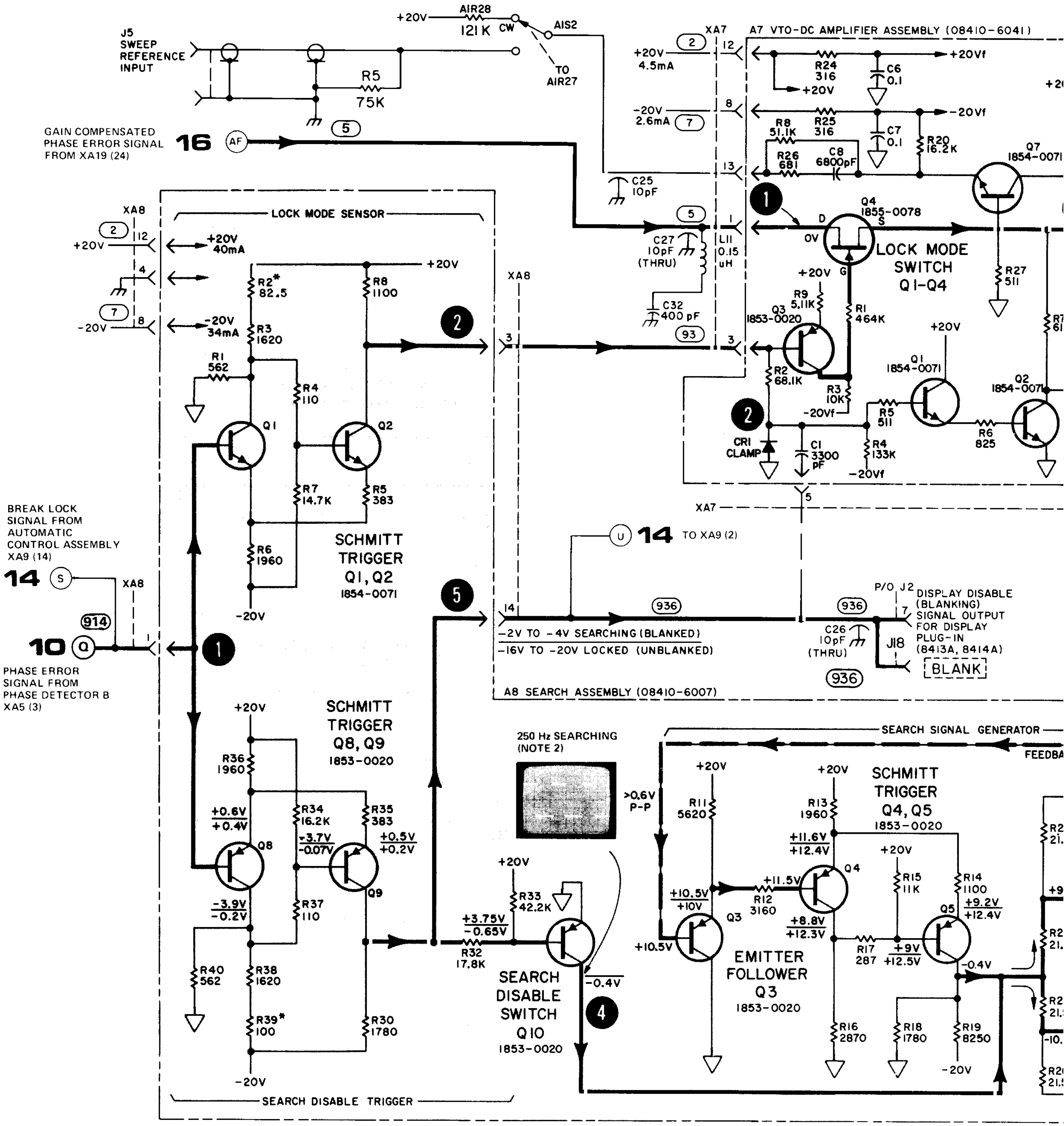


A7

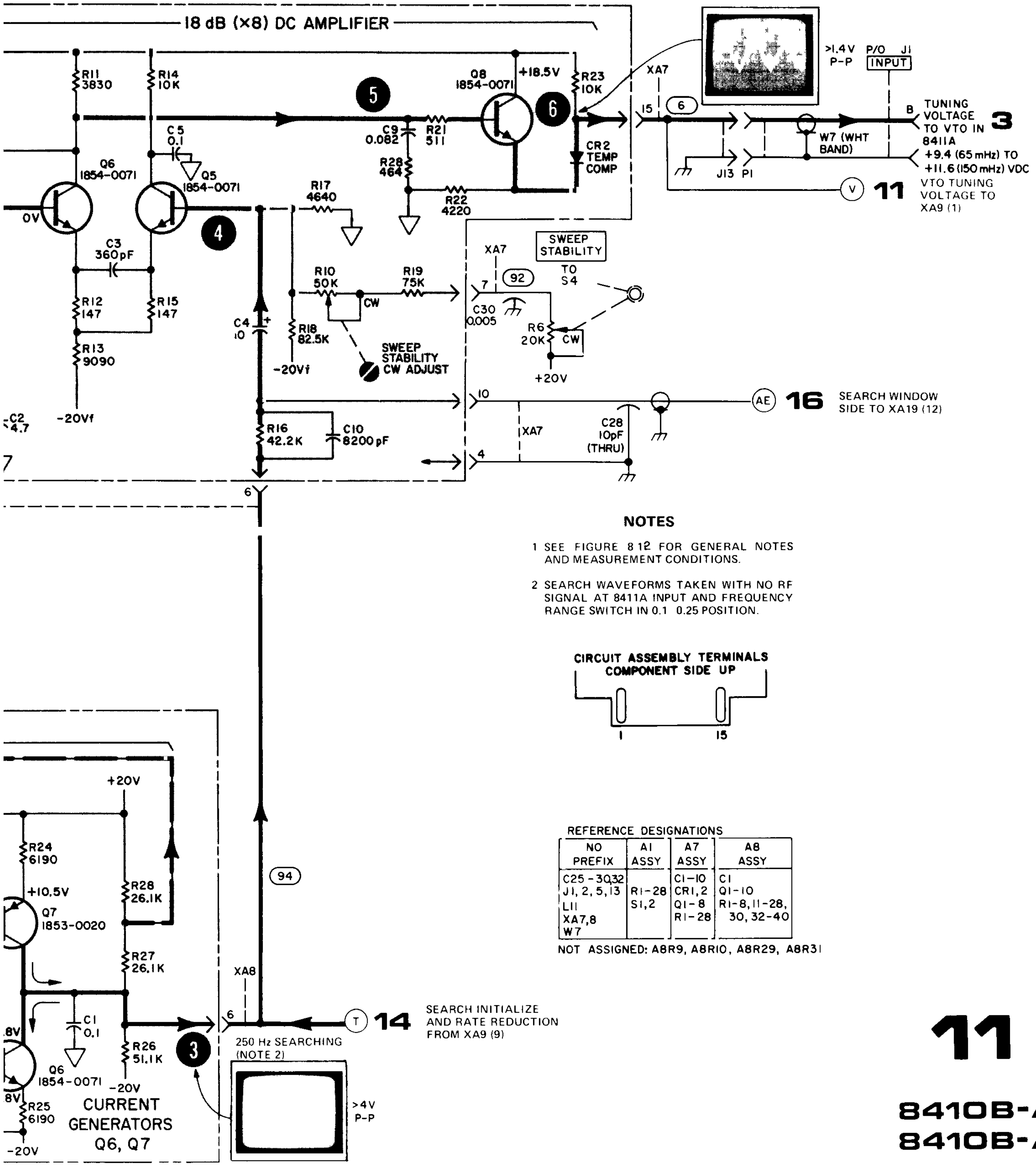


A8

Figure 8-56. 8410B-A7 and A8 Parts Location



SERIAL PREFIX: 1902A DATE: MARCH 1979



NOTES

1. SEE FIGURE 8-12 FOR GENERAL NOTES AND MEASUREMENT CONDITIONS.
2. SEARCH WAVEFORMS TAKEN WITH NO RF SIGNAL AT 8411A INPUT AND FREQUENCY RANGE SWITCH IN 0.1 0.25 POSITION.

CIRCUIT ASSEMBLY TERMINALS COMPONENT SIDE UP

REFERENCE DESIGNATIONS

NO PREFIX	A1 ASSY	A7 ASSY	A8 ASSY
C25-30,32 J1, 2, 5, 13 L11 XA7,8 W7	R1-28 S1,2	C1-10 CR1,2 Q1-8 R1-28	C1 Q1-10 R1-8, 11-28, 30, 32-40

NOT ASSIGNED: A8R9, A8R10, A8R29, A8R31

11

8410B-A7
8410B-A8

Figure 8-57. 8410B-A7 and A8 Schematic Diagram

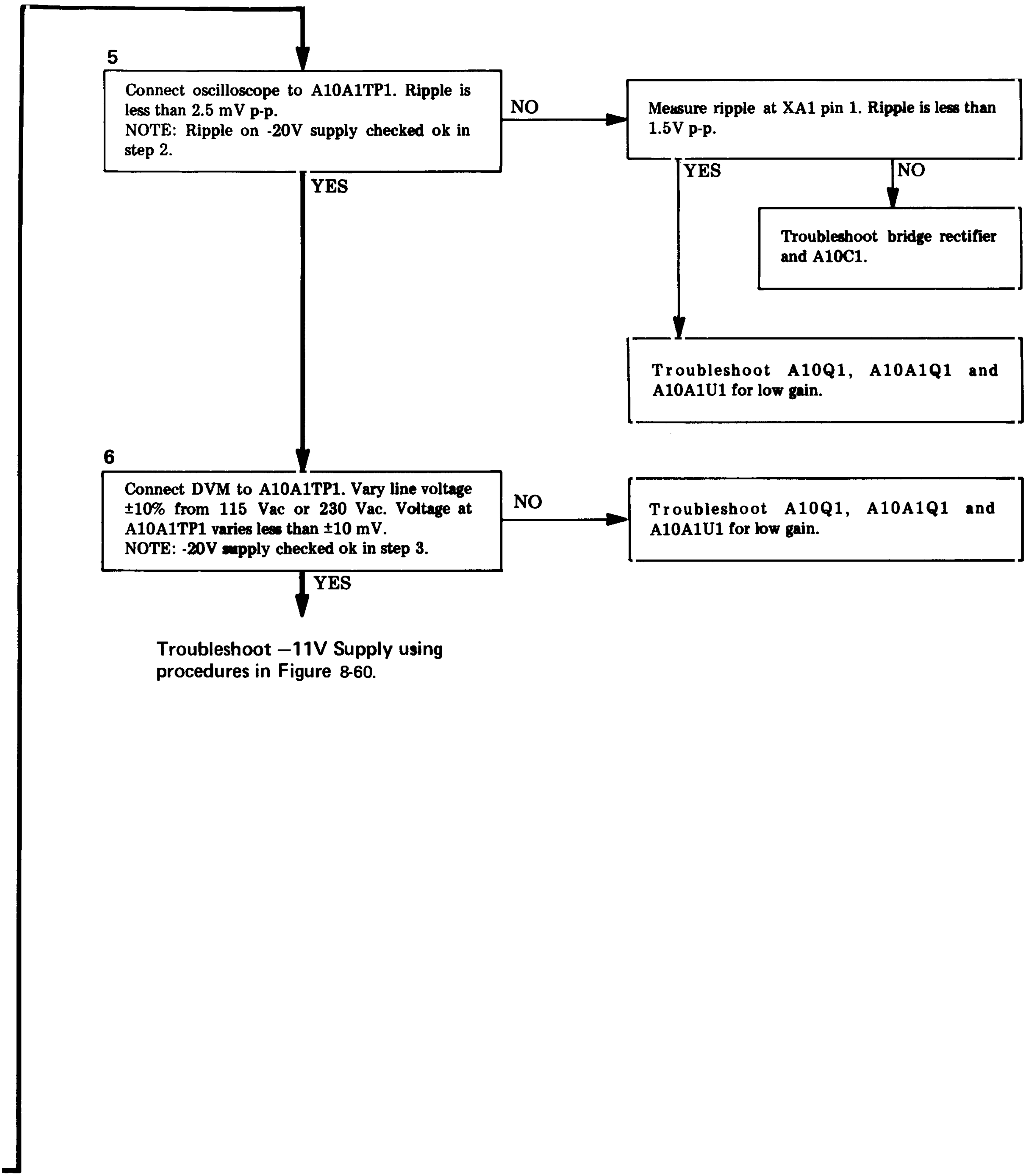
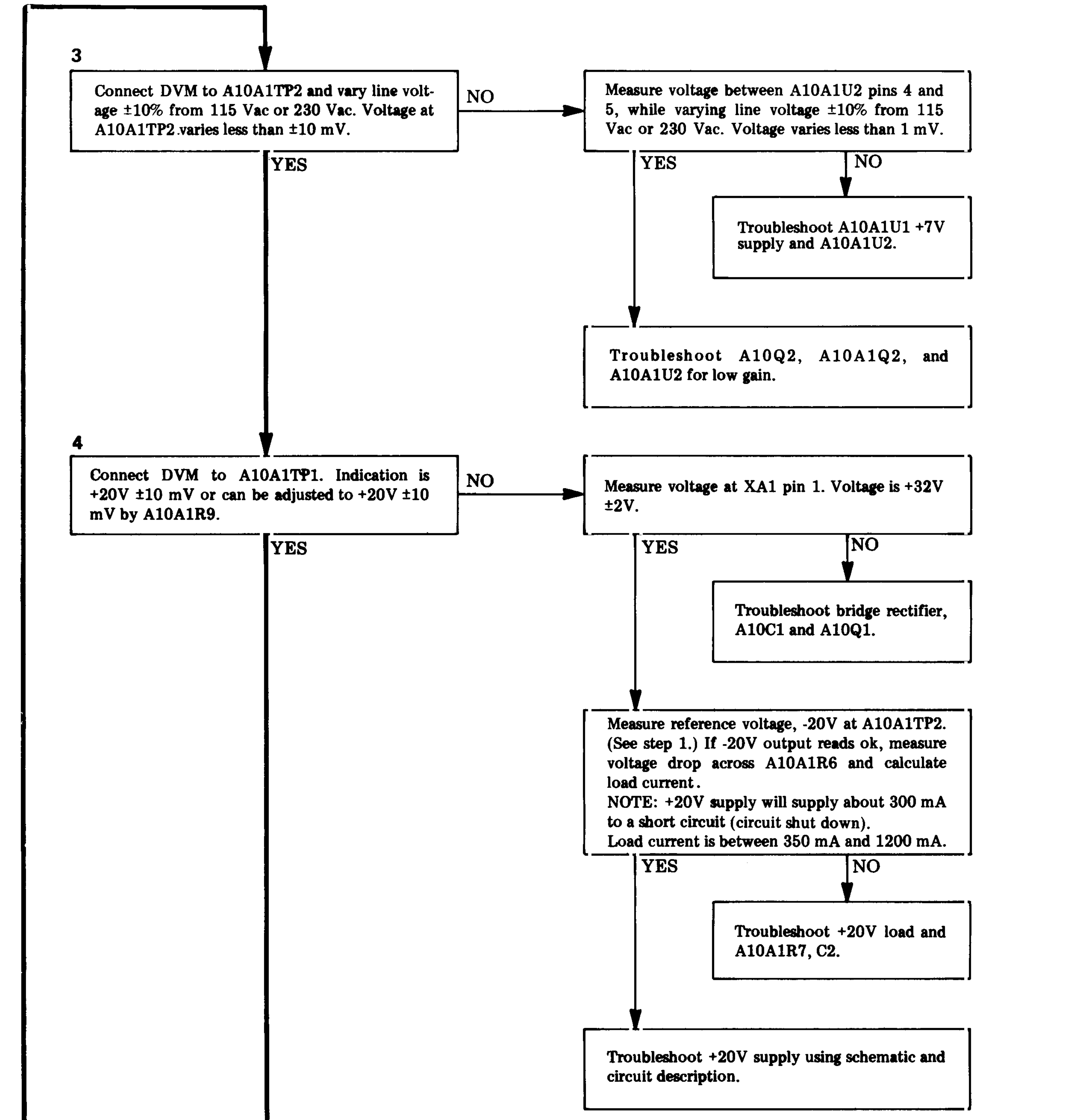
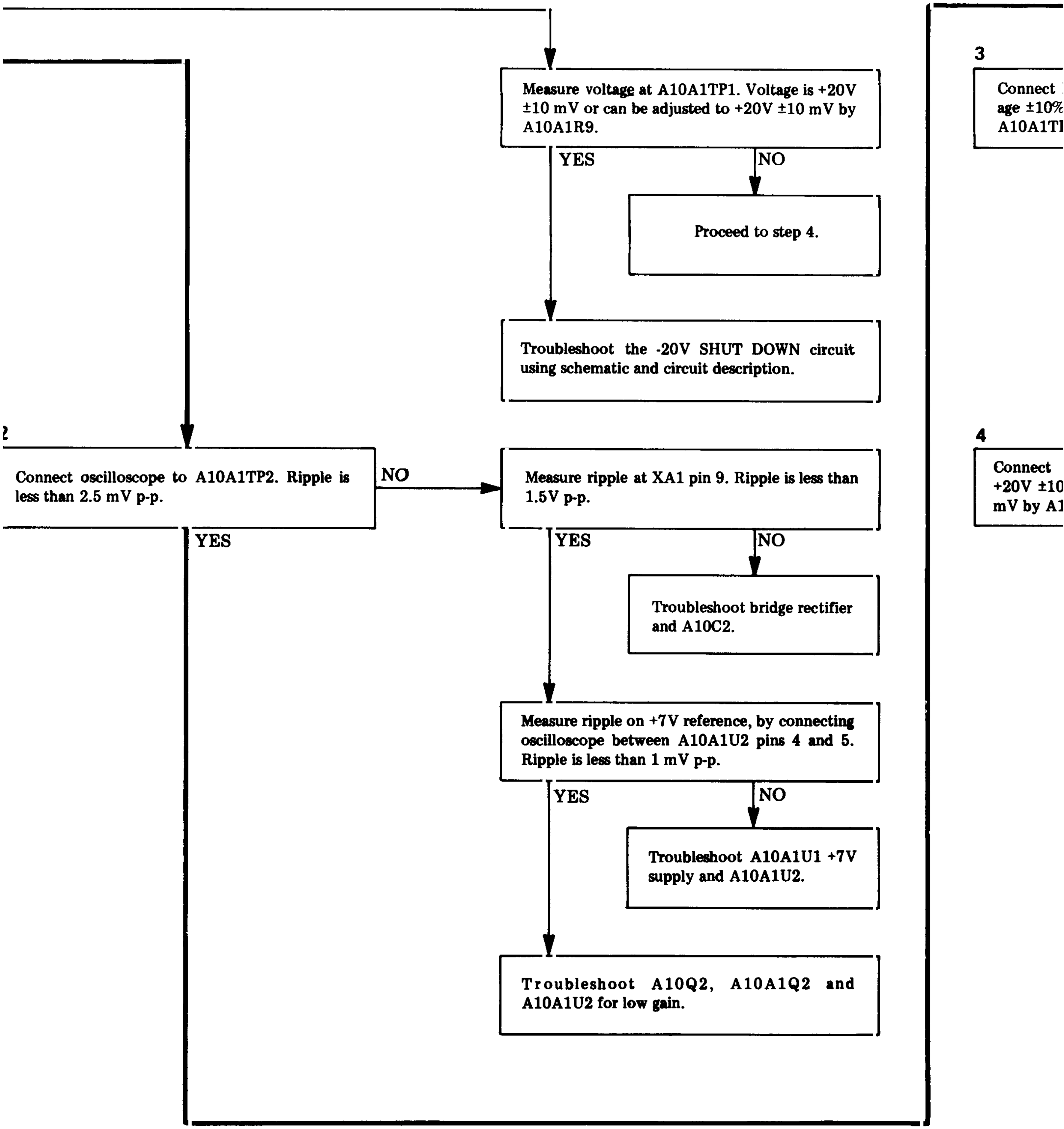


Figure 8-58. 8410B-A10, A10A1 +20V and −20V F
A10 and A10A1 Troubleshooting


3
Connect DVM to A10A1TP2 and vary line voltage ±10% from 115 Vac or 230 Vac. Voltage at A10A1TP2 varies less than ±10 mV.
NO
Measure voltage between A10A1U2 pins 4 and 5, while varying line voltage ±10% from 115 Vac or 230 Vac. Voltage varies less than 1 mV.
YES
NO
Troubleshoot A10A1U1 +7V supply and A10A1U2.
Troubleshoot A10Q2, A10A1Q2, and A10A1U2 for low gain.
YES
4
Connect DVM to A10A1TP1. Indication is +20V ±10 mV or can be adjusted to +20V ±10 mV by A10A1R9.
NO
Measure voltage at XA1 pin 1. Voltage is +32V ±2V.
YES
NO
Troubleshoot bridge rectifier, A10C1 and A10Q1.
Measure reference voltage, -20V at A10A1TP2. (See step 1.) If -20V output reads ok, measure voltage drop across A10A1R6 and calculate load current.
NOTE: +20V supply will supply about 300 mA to a short circuit (circuit shut down).
Load current is between 350 mA and 1200 mA.
YES
NO
Troubleshoot +20V load and A10A1R7, C2.
Troubleshoot +20V supply using schematic and circuit description.
YES



Measure voltage at A10A1TP1. Voltage is +20V ±10 mV or can be adjusted to +20V ±10 mV by A10A1R9.
YES
NO
Proceed to step 4.
Troubleshoot the -20V SHUT DOWN circuit using schematic and circuit description.
2
Connect oscilloscope to A10A1TP2. Ripple is less than 2.5 mV p-p.
NO
YES
Measure ripple at XA1 pin 9. Ripple is less than 1.5V p-p.
YES
NO
Troubleshoot bridge rectifier and A10C2.
Measure ripple on +7V reference, by connecting oscilloscope between A10A1U2 pins 4 and 5. Ripple is less than 1 mV p-p.
YES
NO
Troubleshoot A10A1U1 +7V supply and A10A1U2.
Troubleshoot A10Q2, A10A1Q2 and A10A1U2 for low gain.
3
Connect
age ±10%
4
Connect
+20V ±10
mV by A1

8410B POWER SUPPLY, −20V AND +20V SECTION A10 AND A10A1, TROUBLESHOOTING

1

Connect DVM to A10A1TP2. Indication is -20V ±10 mV or can be adjusted to -20V ±10 mV by A10A1R22.

- YES
- NO → Measure voltage at A10 XA1 pin 9. Voltage is −32V ±2V.
  - NO → Troubleshoot bridge rectifier and A10C2.
  - YES → Measure voltage at A10A1U2 pin 8. Voltage is +7V ±0.5V.
    - NO → Troubleshoot A10A1U1 +7V supply and A10A1U2.
    - YES → Measure voltage drop across A10A1R16 and calculate load current. Load current is less than 1200 mA.
      - NO → Troubleshoot -20V load and A10A1R7, C4.
      - YES → Disable SHUT DOWN circuit by removing A10A1Q3 or shorting E to B. -20V output is -20V ±10 mV or can be adjusted to -20V ±10 mV by A10A1R22.
        - NO → Troubleshoot -20V supply using schematic and circuit description.
        - YES

8410B +20V AND −20V POWER SUPPLY A10 AND A10A1, CIRCUIT DESCRIPTION

+20V SUPPLY

The +7V supply has a voltage regulated output that is used in the −20V and −11V supplies.

Part of A10A1U1 is a differential amplifier. It compares voltages at U1 pin 2 and pin 3 and amplifies the difference. If +20V output goes more positive, pin 2 goes more positive than pin 3, resulting in a positive at the inverting input. This causes the amplifier's output to go negative.

A voltage amplifier in A10A1U1 amplifies the error signal from the Differential Amplifier. A negative input from the differential amplifier causes the output to go positive.

A current limiter resistor A10A1R6 senses load current. As load current approaches 1 A, the voltage drop across R6 turns on the current limiter, causing a negative-going input to U1's voltage amplifier which decreases the supply output voltage and limits current to about 300 mA.

Driver A10A1Q1 is a voltage amplifier. A positive input from U1's voltage amplifier causes the output to go negative.

Series regulator A10Q1 acts as a variable resistor. It's resistance varies inversely with collector current. That is, a negative voltage from its driver decreases collector current causing resistance to increase. This drops more voltage across the regulator, decreasing output voltage.

Voltage divider A10A1R11 and R12 samples output voltage. With output at +20V, U1 pin 3 is at about +2V.

Voltage divider A10A1R8, R9 and R10 compares +20V supply against −20V supply.

A10A1C1 and A10A1R1 provide frequency compensation to prevent the supply from oscillating.

NOTE

The −20V supply should always be adjusted first. The −20V output is the reference voltage for the +20V and −11V supplies. If the −20V output goes more negative, the −11V output follows and the +20V output goes more positive.

8410B +20V AND −20V POWER SUPPLY A10 AND A10A1, CIRCUIT DESCRIPTION (Cont'd)

−20V SUPPLY

The voltage reference section of A10A1U2 establishes a reference voltage for the −20V supply. U2 pin 5 samples the supply's output voltage. Pin 4 is always about 7V more positive than pin 5. Current through pin 4 is negligible so pin 3 is at nearly the same voltage as pin 4. The reference voltage at pin 3 follows any change in the supply's output.

The differential voltage amplifier section of A10A1U2 compares the voltage at U2 pin 3 and pin 2, and amplifies the difference. If the −20V output goes more negative, pin 3 goes more negative than pin 2, resulting in a negative at the non-inverting input. This causes the amplifier's output to go negative.

The current amplifier in A10A1U2 provides drive to Driver A10A1Q2. A negative input from the differential amplifier decreases the current amplifier's conduction which is also the conduction of A10A1Q2.

Resistor A10A1R16 senses load current. As load current approaches 1200 mA, the voltage drop across R16 turns on the current limiter in U2, causing a negative-going input to U2's current amplifier. This decreases its conduction, which will shut down the supply's output voltage.

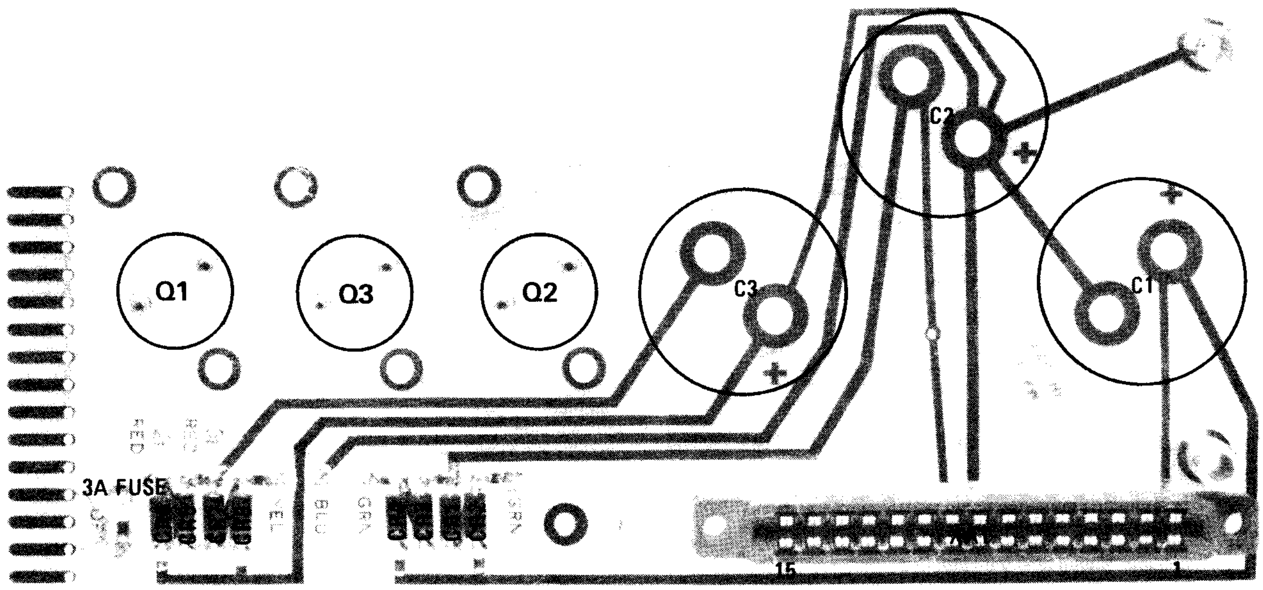
The conduction of driver A10A1Q2 varies directly with U2's current amplifier conduction. If conduction of Q2 decreases, base drive to series regulator A10Q2 decreases.

Series regulator A10Q2 acts as a variable resistor whose resistance varies inversely with collector current. That is, a decrease in base drive from A10A1Q2 decreases the regulator's collector current. This causes the resistance to increase dropping more voltage across the regulator, and causing the output voltage to go less negative or in a positive direction.

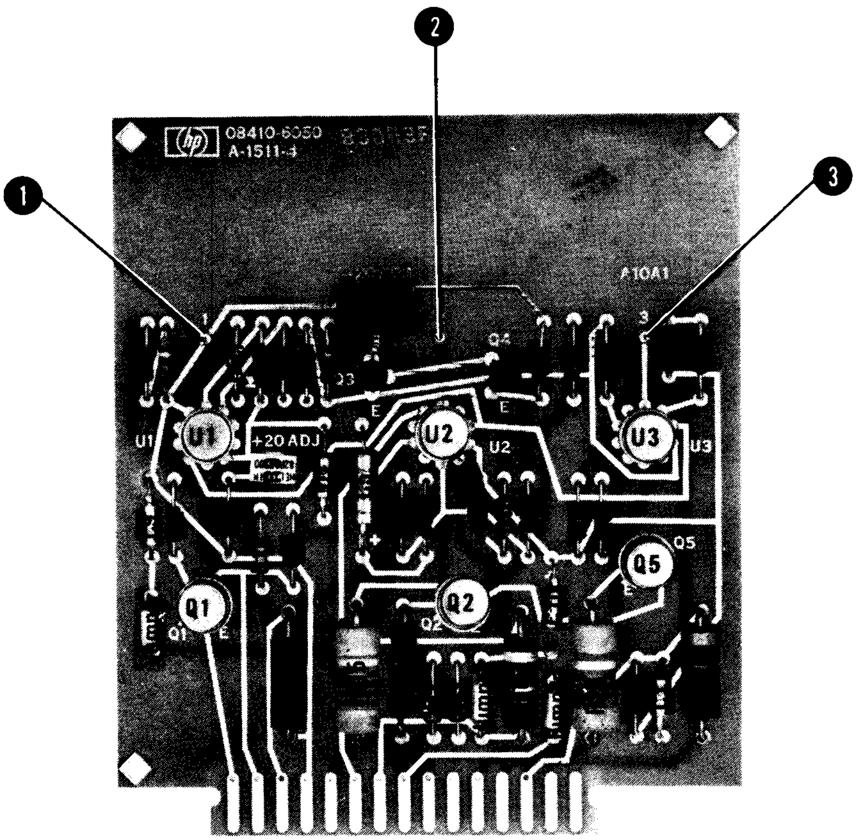
Shut down A10A1Q3 and Q4 shuts down the −20V supply when the +20V supply is shorted. Q4 is normally conducting, holding Q3 at cut off. If the +20V output goes to zero, Q4 shuts off, causing Q3 to conduct. Q3 conducting presents a positive-going signal at U2 pin 2, the inverting input. U2's differential amplifier's output goes negative which shuts down the −20V output. Because of the 7V difference between U2 pin 4 and pin 5, the output shuts down to about −7V.

Voltage divider A10A1R21, R22, and R23 samples the output voltage. With the output at −20V, U2 pin 2 is at about −13V.

A10A1CR2 and CR3 develops base bias for A10A1Q2 and Q5.

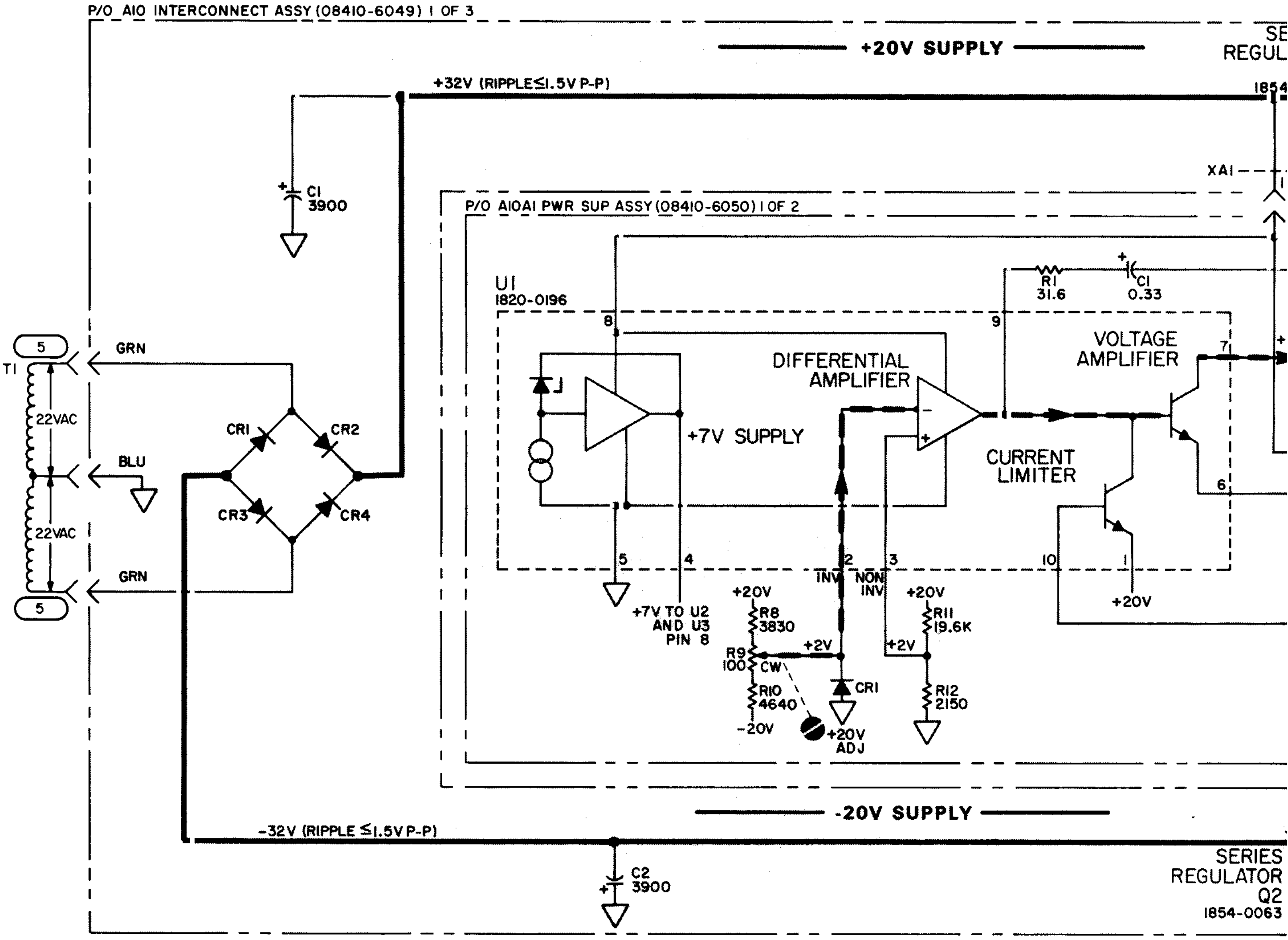


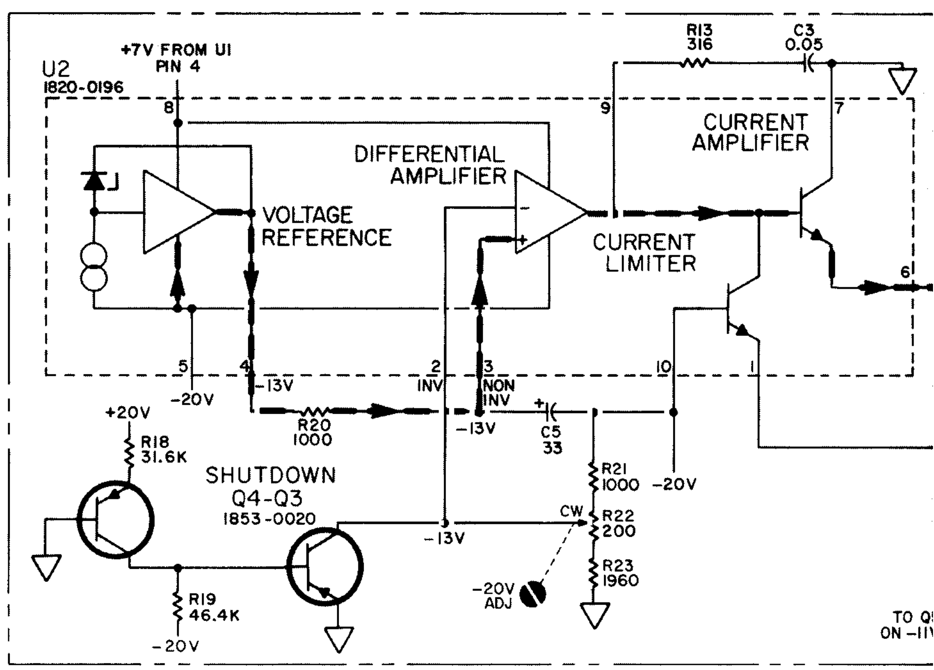
A10



A10A1

Figure 8-59. 8410B-A10A1 Parts Location

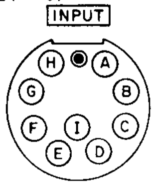




NOTES

1. SEE FIGURE 8-10 FOR GENERAL NOTES AND MEASUREMENT CONDITIONS

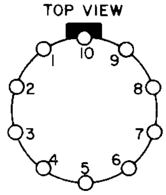
2. J1 INPUT



VIEWED FROM FRONT PANEL

4. CONNECTION DIAGRAM FOR U1-U2

TOP VIEW

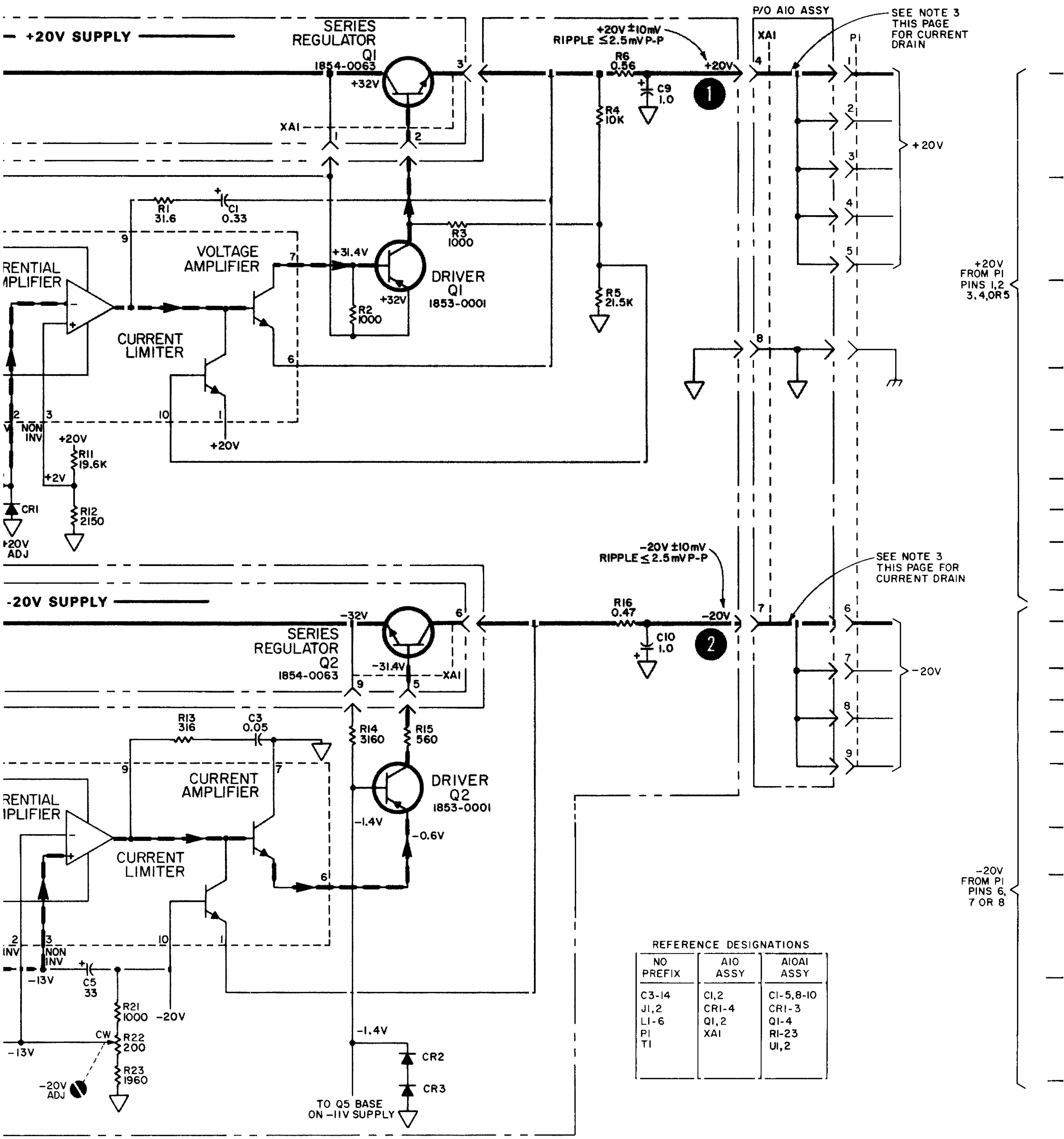


NOTE: PIN 5 IS CONNECTED TO CASE

3. TYPICAL CURRENT DRAIN

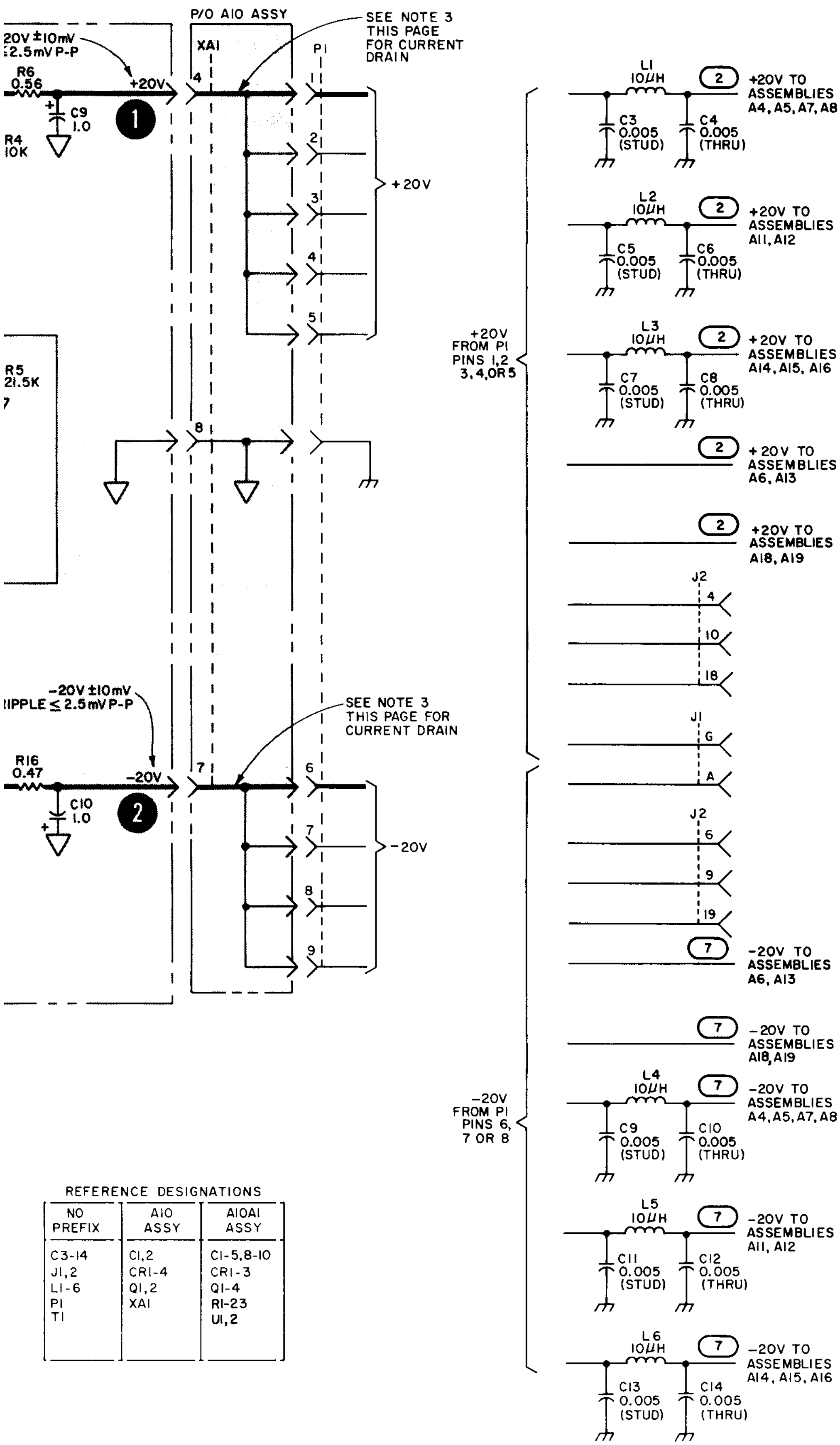
INSTRUMENTS	+20V	−20V
8410B	300 mA	250 mA
8410B/8411A	410 mA	485 mA
8410B/8411A/8412A	530 mA	640 mA
8410B/8411A/8413A	670 mA	620 mA
H26-8410B/8411A/8413A	870 mA	740 mA
8410B/8411A/8414A	760 mA	560 mA

SERIAL PREFIX: 1902A DATE: MARCH 1979



REFERENCE DESIGNATIONS

NO PREFIX	A10 ASSY	A10A1 ASSY
C3-14 J1,2 L1-6 P1 T1	C1,2 CR1-4 Q1,2 XA1	C1-5,8-10 CR1-3 Q1-4 R1-23 U1,2



REFERENCE DESIGNATIONS

NO PREFIX	A10 ASSY	A10A1 ASSY
C3-14 J1,2 L1-6 P1 T1	C1,2 CR1-4 Q1,2 XA1	C1-5,8-10 CR1-3 Q1-4 R1-23 U1,2

12

P/O 8410B-A10
P/O 8410B-A10A1
ALSO: 8410B-C3 THRU C14, L1 THRU L6, AND P/O T1

Figure 8-60. 8410B +20V and –20V Power Supply Schematic

8410B −11V POWER SUPPLY A10 AND A10A1, CIRCUIT DESCRIPTION

The differential amplifier in A10A1U3 compares voltage at U3 pin 2 and pin 3 and amplifies the difference. If the −11V output goes more negative, pin 3 goes more negative than pin 2, resulting in a negative at the noninverting input. This causes the amplifier's output to go negative. A negative input from the differential amplifier decreases the current amplifier's conduction which is also the conduction of A10A1Q5.

Current limiter resistor A10A1R26 senses load current. As load current approaches 1200 mA, the voltage drop across R26 turns on the current limiter causing a negative going input to U3's current amplifier. This decreases its conduction which shuts down the supply's output voltage. The −11V supply will supply about 1200 mA to a short circuit.

Conduction of Driver A10A1Q5 varies directly with U3's current amplifier conduction. If conduction of A10A1Q5 decreases, base drive to series regulator A10Q3 decreases.

Series regulator A10Q3 acts as a variable resistor whose resistance varies inversely with collector current. That is, a decrease in base drive from A10A1Q5 decreases the regulator's collector current. This, in turn, increases the effective resistance of the regulator and drops more voltage across the regulator, causing the output voltage to go less negative.

A voltage divider composed of A10A1R31 and R32 samples the output voltage. With output at −11V, U3 pin 3 is at about −8V.

A voltage divider composed of A10A1R29 and R30 samples the −20V reference. With the −20V supply operating normally, the voltage at U3 pin 2 is about −8V and equal to the voltage at U3 pin 3. The −11V output follows any change in the −20V output, and if the −20V output is shorted, the −11V supply shuts down.

NOTE

If the −11V output is shorted the ±20V supplies are not affected.

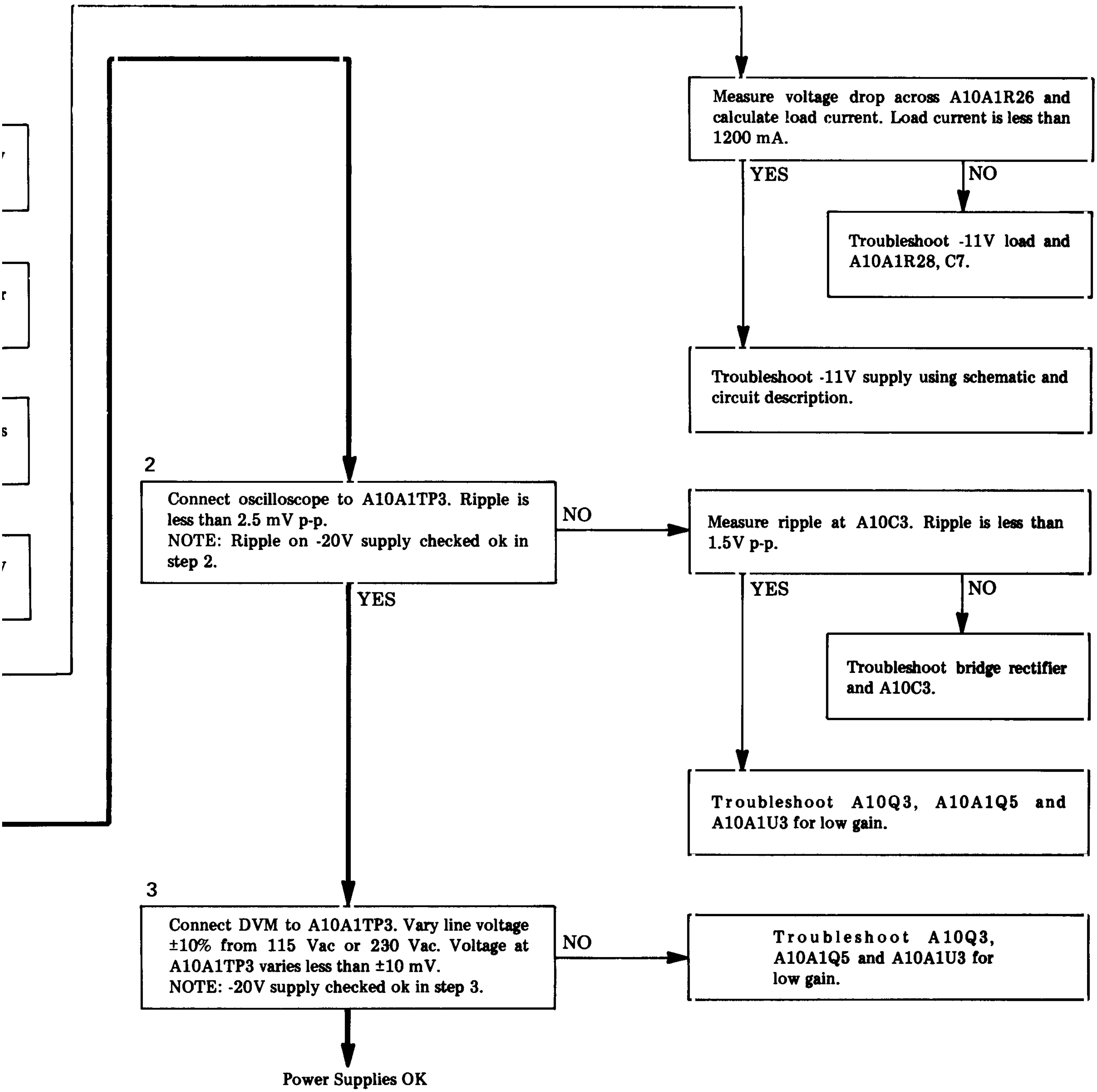
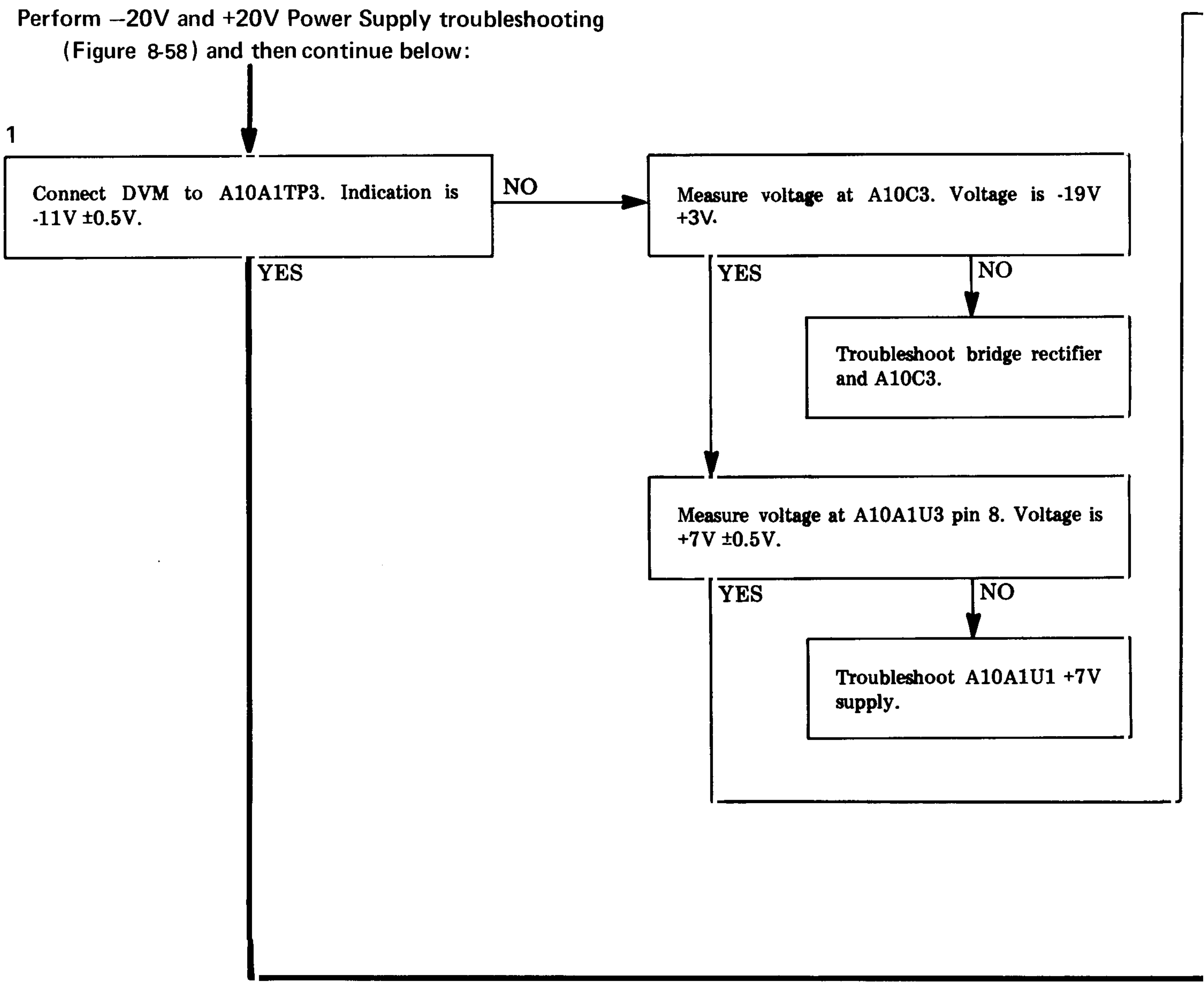
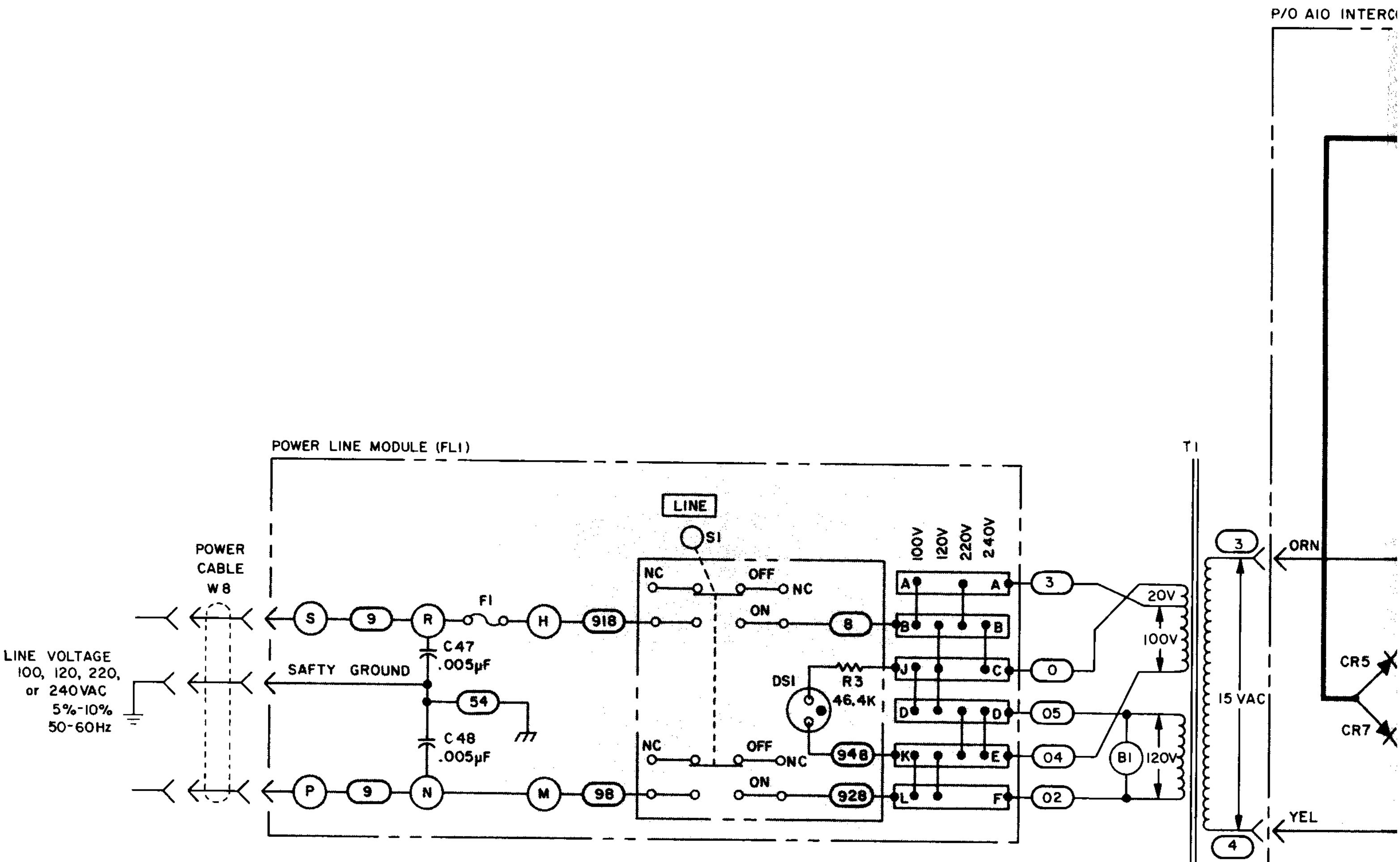
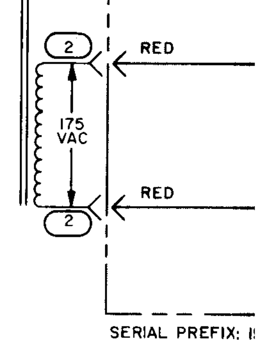


Figure 8-61. 8410B-A10, A10A1 –11V Power Supply Troubleshooting



Perform –20V and +20V Power Supply troubleshooting (Figure 8-58) and then continue below:
1
Connect DVM to A10A1TP3. Indication is -11V ±0.5V.
NO
YES
Measure voltage at A10C3. Voltage is -19V +3V.
YES
NO
Troubleshoot bridge rectifier and A10C3.
Measure voltage at A10A1U3 pin 8. Voltage is +7V ±0.5V.
YES
NO
Troubleshoot A10A1U1 +7V supply.





REFERENCE DESIGNATIONS

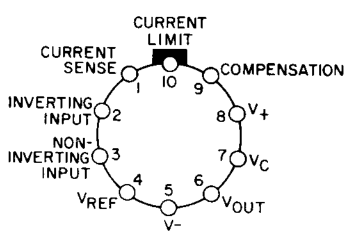
NO PREFIX	A10 ASSY	A10A1 ASSY
B1 C31A/B DS1 F1 J1, 2, 14 P1 R3 S1, 2 T1 W8	C3 CR5-8 Q3 XA1	C6, 7 Q5 R24-32 U3

NOT ASSIGNED: R4

NOTES:

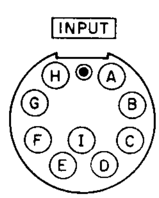
1. SEE FIGURE 8-10 FOR GENERAL NOTES AND MEASUREMENT CONDITIONS
2. FOR U3

TOP VIEW

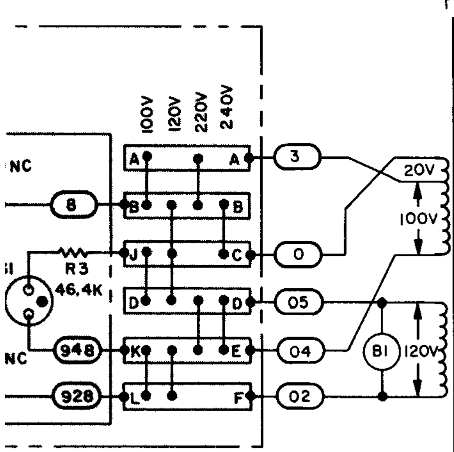


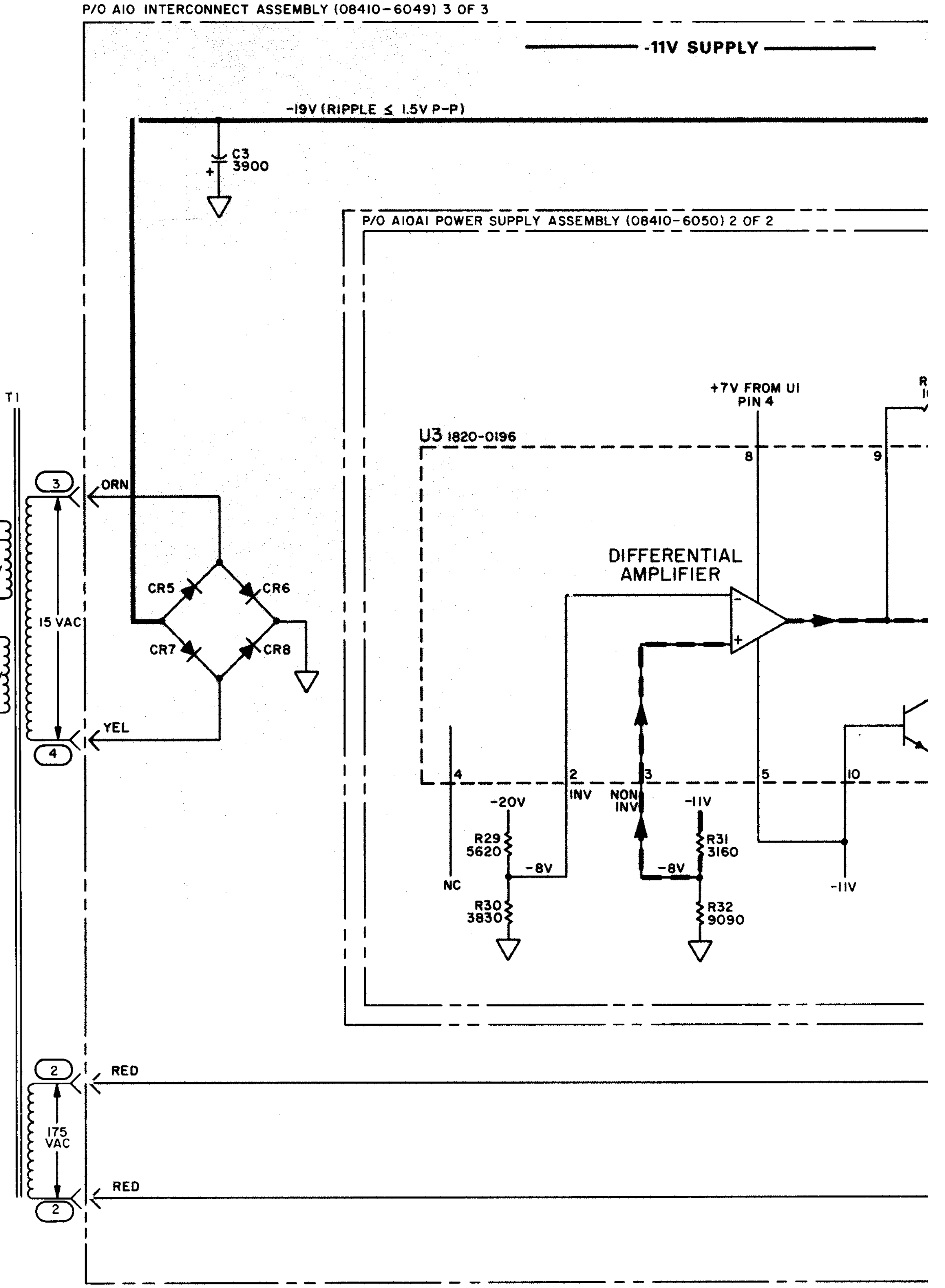
NOTE: PIN 5 IS CONNECTED TO CASE

3. J1



VIEWED FROM FRONT PANEL



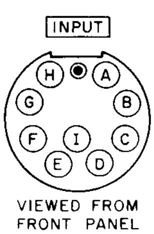


REFERENCE DESIGNATIONS

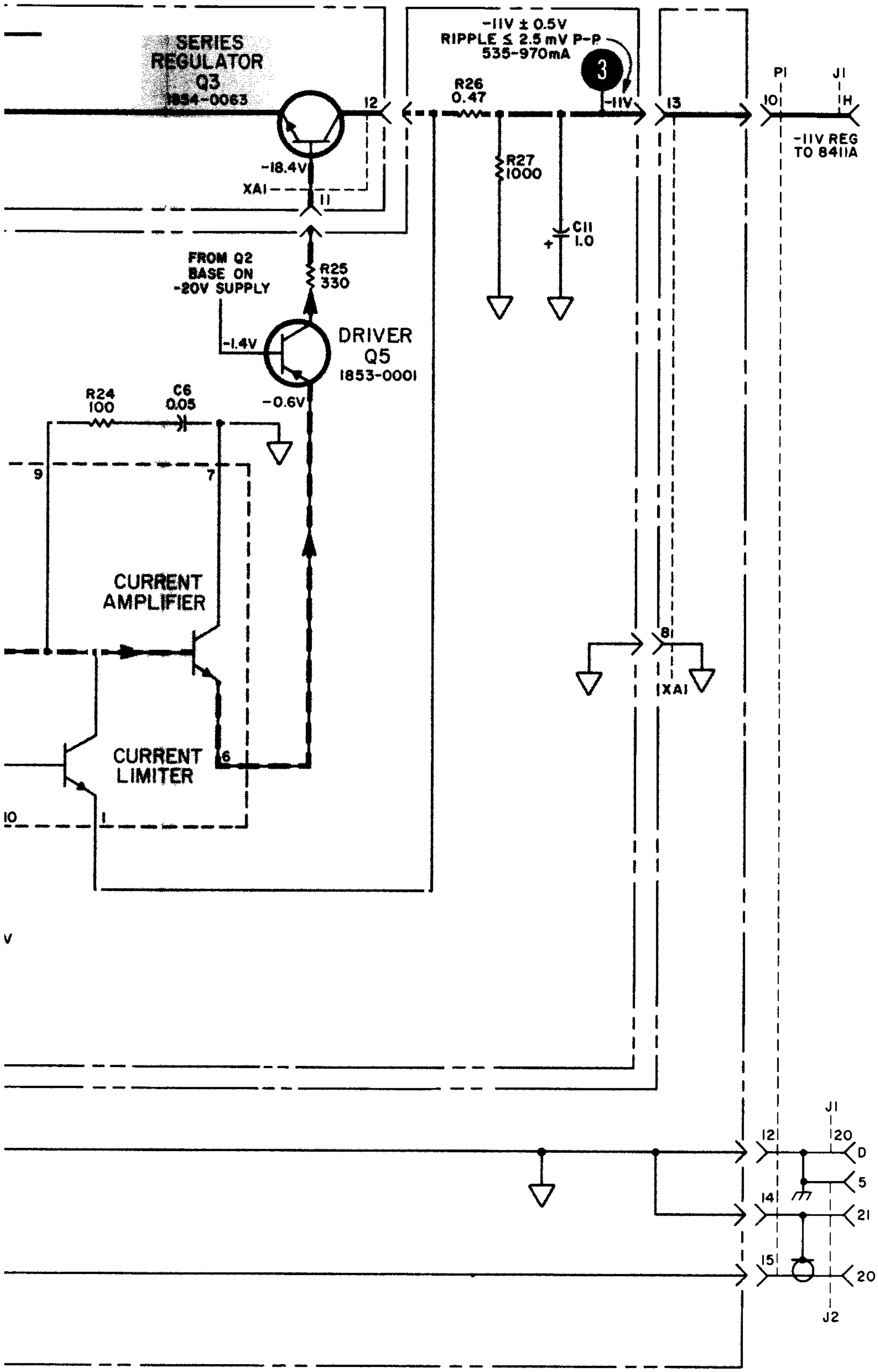
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B1	C3	C6, 7
C31A/B	CR5-8	Q5
DS1	Q3	R24-32
F1	XA1	U3
J1, 2, 14		
P1		
R3		
S1, 2		
T1		
W8		

NOT ASSIGNED: R4

3. J1



SERIAL PREFIX: 1902A DATE: MARCH 1979



13

P/O 8410B-A10
P/O 8410B-A10A1
ALSO: 8410B-FL1, T1, AND W8

Figure 8-62. 8410B −11V Power Supply Schematic Diagram

8410B AUTOMATIC CONTROL A9, CIRCUIT DESCRIPTION

(changes YIG harmonics). When either of these occur, the sweeper drops the DC level to 0V. Q4 is shut off and the voltage at TP8 goes high (+10V). The change in voltage at TP8 triggers the External Trigger Monostable (U2A), and a low (0V) pulse is generated at TP9.

MONOSTABLE OPERATION

The Hold Allow, A/D Converter, and Loop Initialize monostables, U2B, U3A, and U3B, are connected in parallel, and fired at the same time by either trigger source (U2A or U4). When FREQ RANGE (GHz) A1S1 is in a selected frequency range, the low (0V) DC level at TP4 disables the monostables (U2B, U3A, U3B).

HOLD ALLOW MONOSTABLE

When fired by either trigger source, U3A generates a high (+10V) pulse of typically 15 msec at TP5. This pulse enables the STOP SWEEP signal to be generated.

A/D CONVERT MONOSTABLE

When fired by either trigger source, U2B generates a high (+10V) pulse of typically 0.5 msec at TP10. This pulse enables the frequency range selection to be updated on the Frequency Range Assembly (A19).

LOOP INITIALIZE MONOSTABLE

When fired by either trigger source, U3B generates a low (0V) pulse of typically 1.5 msec at TP6. This pulse is used to generate the Break Lock and Search Initialize signals.

LOCK DETECTION

When the 8410B Network Analyzer is not phase locked, a high (−4V) DC level at XA9-2 biases Q1 on and drops the DC level at TP2 to 0V.

SWEEP DELAY

A low (0V) DC level at TP2 causes the outputs of U1A and U1B to go high (+10V). The output of U1A turns on Q2 to set the DC level of U1B-6 to 0V. When the 8410B Network Analyzer regains phase lock, the DC level at TP2 becomes high (+10V) and Q2 is shut off. However the DC level at U1B-6 remains low until C1 charges up through R17 and R18, causing the output of U1B to remain high (+10V) for approximately 1.6 msec after the network analyzer has retained phase lock.

STOP SWEEP

Only when both inputs to U1C are high (+10V), is a STOP SWEEP (+10V) DC level present at TP3. This signal turns on Q5, which effectively grounds the STOP SWEEP line to the sweeper (J17-7).

BREAK LOCK

The low (0V) DC level on TP6 turns off Q9, which turns on Q8 to give a typically +1V Break Lock signal to the A8 Search Assembly.

SEARCH INITIALIZE

The Search Initialize circuit provides a signal that sends the search oscillator and 8411A VTO to a repeatable starting point. A low (0V) signal at TP6 shuts off Q10 which turns on Q7. The emitter of Q7 goes positive and through CR2 clamps the Search Signal Generator (P/O A8) to a repeatable starting point.

SEARCH RATE REDUCTION

A high (0V) signal on the gate of Q6 turns Q6 on to switch R34 and C8 in parallel with the search signal from the A8 Search Assembly. This RC network slows the search rate for the two lowest and the highest octave bands.

AUTO MODE

In the AUTO mode of operation, the Automatic Control Assembly, A9, provides the timing and logic necessary to keep the 8410B Network Analyzer phase locked and tracking with the RF sweeper source. When triggered, the Automatic Control Assembly starts the automatic relocking cycle with the simultaneously generated control signals as follows:

1. BREAK LOCK - Simulates a large phase error signal to the A8 Search Assembly.

2. SEARCH INITIALIZE - Sets the Search Signal Generator (P/O A8) to a repeatable starting point.

3. STOP SWEEP - Stops the sweeper until the 8410B Network Analyzer is phase locked and stable.

4. CONVERT - Control signal to the A/D CONVERTER Assembly (A18) to enable an update of frequency range selection.

When the FREQ RANGE (GHz) is in a manually selected frequency range, the A9 Automatic Control Assembly is disabled by a high on the auto disable line.

VTO LIMIT TRIGGER

The output of U4 (TP7) becomes high (+10V) when the VTO tuning voltage (XA9-1) becomes greater than the VTO Trigger Threshold voltage (TP1). This triggers the automatic relocking cycle when the 8411A VTO reaches its frequency range limit.

EXTERNAL TRIGGER

The base of Q4 is held at +5V until the sweeper either begins sweeping after a retrace, or the sweeper switches itself through a sequential break

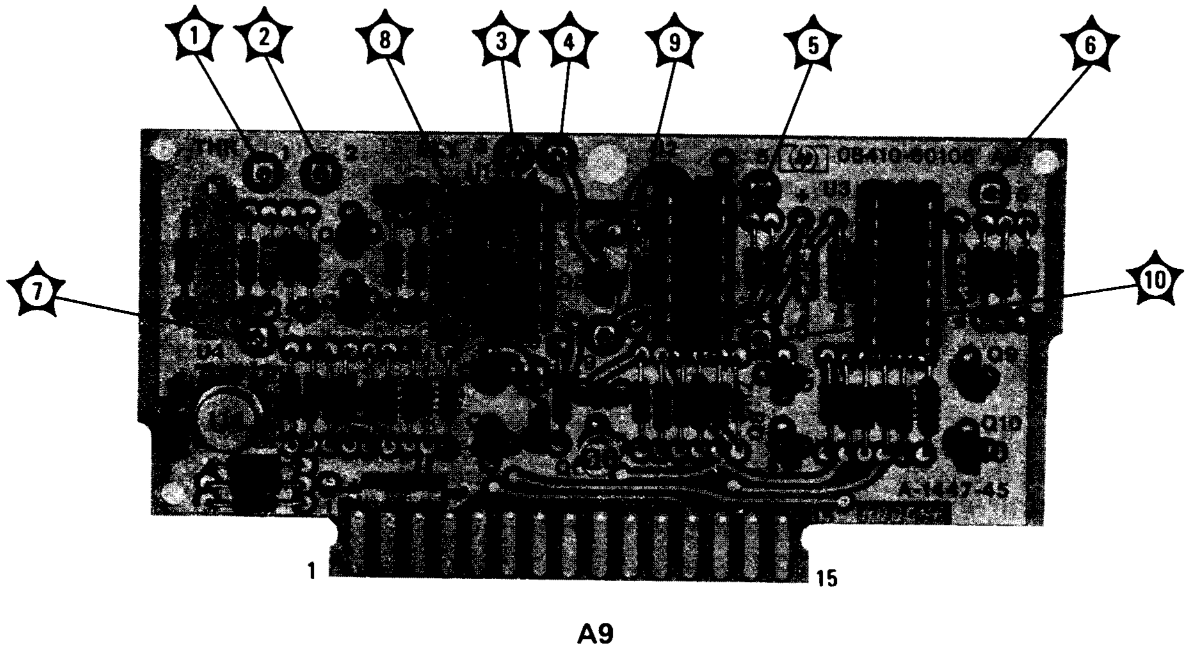
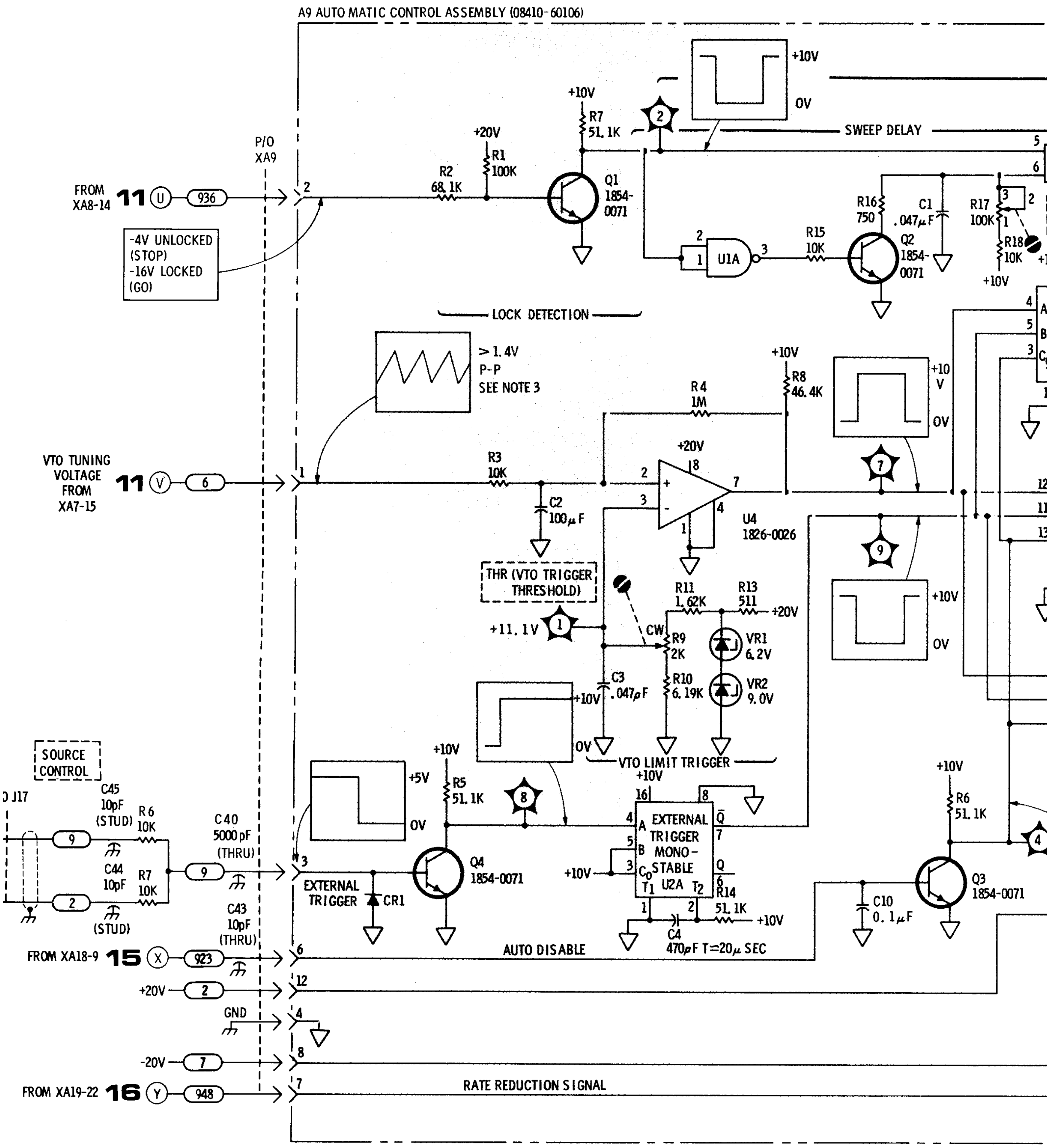
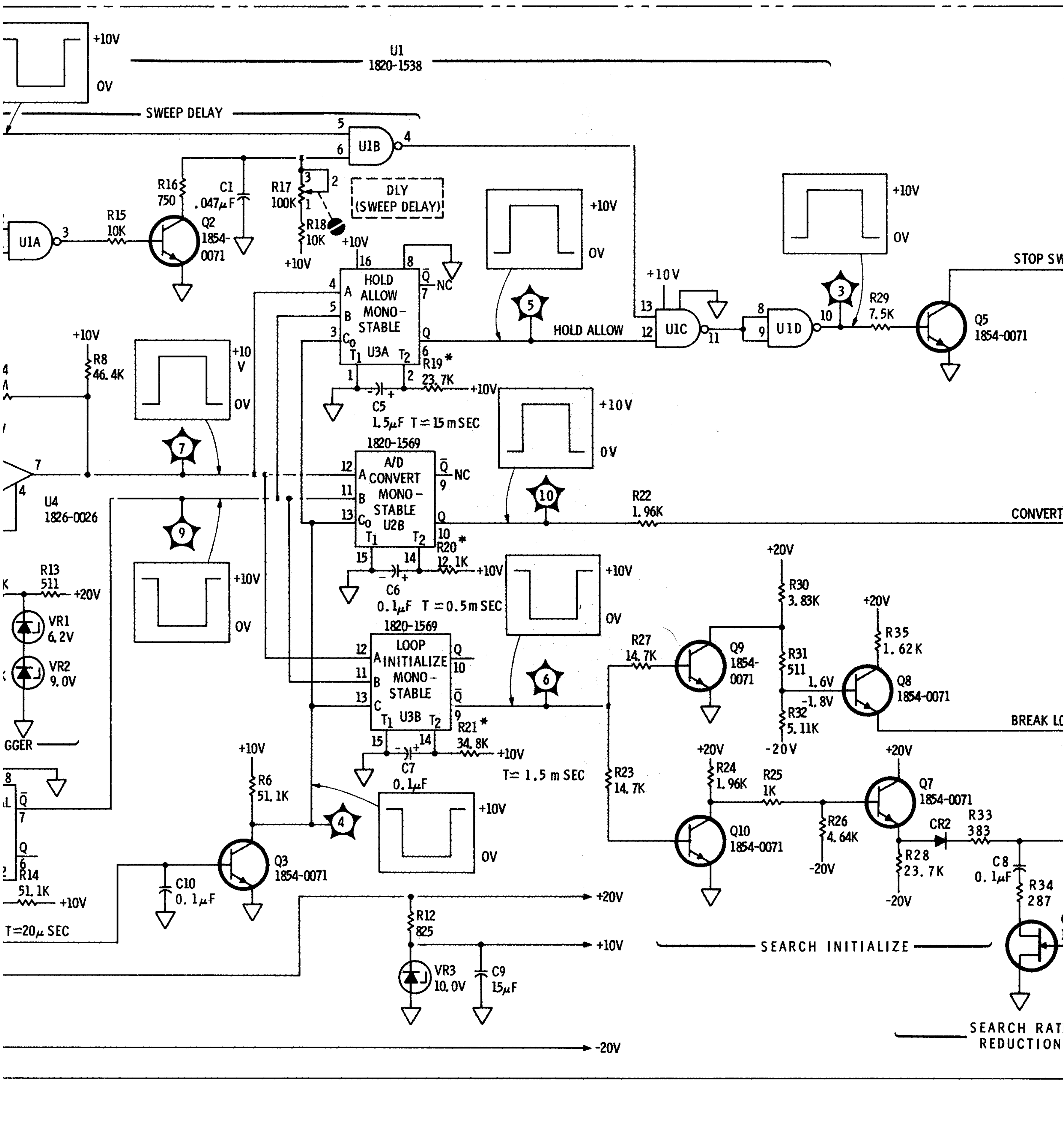


Figure 8-63. 8410B-A9 Parts Location



SERIAL PREFIX: 1902A DATE: MARCH 1979



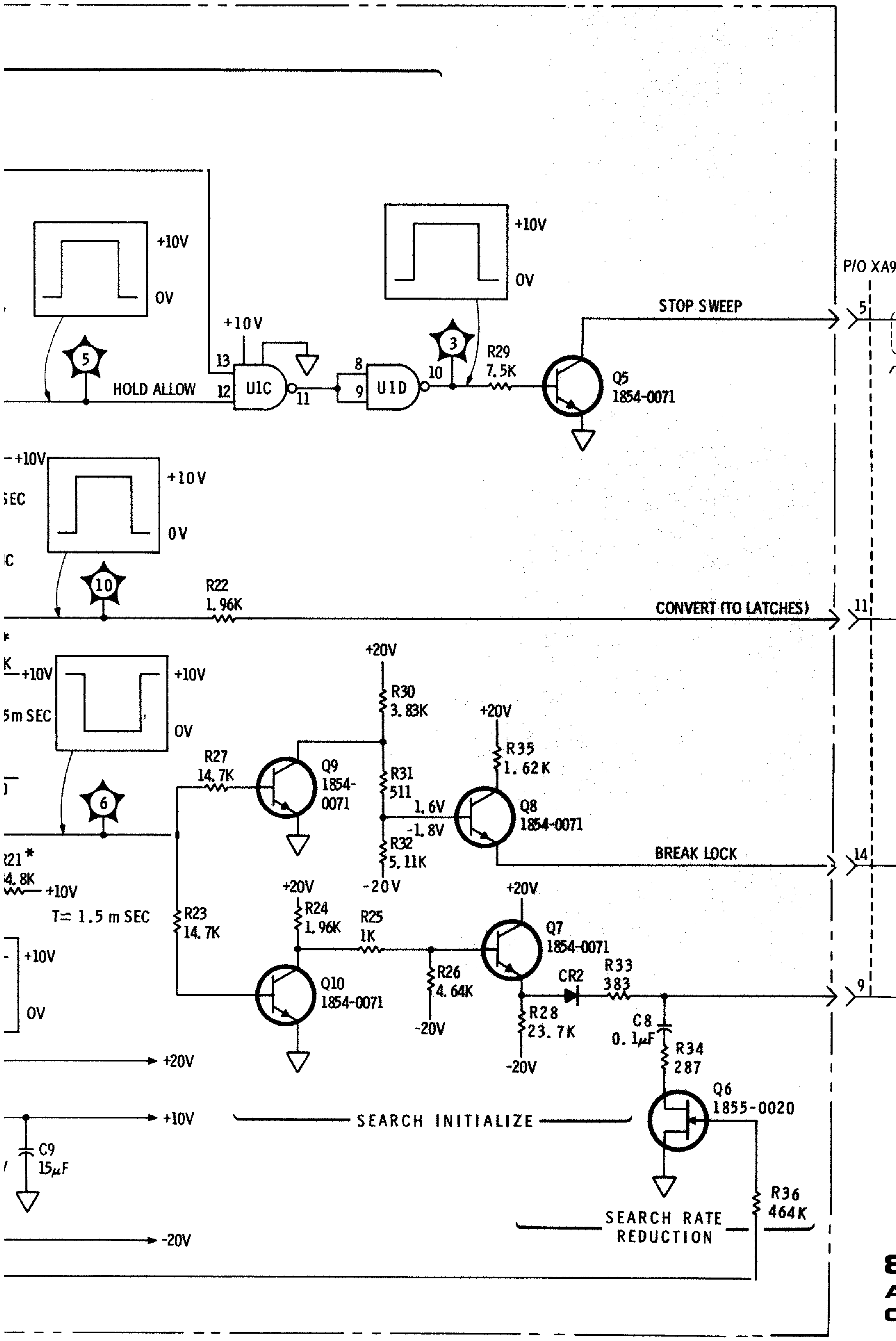
U1
1820-1538
SWEEP DELAY
U1A
U1B
U1C
U1D
R15 10K
R16 750
C1 .047µF
Q2 1854-0071
R17 100K
R18 10K
DLY (SWEEP DELAY)
HOLD ALLOW MONO-STABLE U3A
R19* 23.7K
C5 1.5µF T = 15 mSEC
HOLD ALLOW
Q5 1854-0071
R29 7.5K
STOP SW
R8 46.4K
1820-1569
A/D CONVERT MONO-STABLE U2B
R20* 12.1K
C6 0.1µF T = 0.5 mSEC
R22 1.96K
CONVERT
U4 1826-0026
R13 511
VR1 6.2V
VR2 9.0V
1820-1569
LOOP INITIALIZE MONO-STABLE U3B
R21* 34.8K
C7 0.1µF
T = 1.5 m SEC
R30 3.83K
R31 511
R32 5.11K
R27 14.7K
Q9 1854-0071
R35 1.62K
Q8 1854-0071
1.6V
-1.8V
BREAK LO
R23 14.7K
R24 1.96K
R25 1K
R26 4.64K
Q10 1854-0071
Q7 1854-0071
CR2
R33 383
R28 23.7K
C8 0.1µF
R34 287
R6 51.1K
Q3 1854-0071
C10 0.1µF
R14 51.1K
T=20µ SEC
GGER
R12 825
VR3 10.0V
C9 15µF
+20V
+10V
-20V
SEARCH INITIALIZE
SEARCH RATE REDUCTION

NOTES

1. SEE FIGURE 8-10 FOR GENERAL NOTES
2. SEE 8410B TROUBLESHOOTING PROCEDURE PART II FOR MEASUREMENT CONDITIONS.
3. WAVEFORM SHOWN IS 250Hz SEARCH TAKEN WITH NO RF SIGNAL AT 8411A INPUT AND FREQUENCY RANGE SWITCH IN 0.1-0.25 POSITION. WHEN PHASE LOCKED, THIS SIGNAL IS +9.4Vdc WHEN 8411A VTO IS 65mHz AND +11.6Vdc WHEN VTO IS 150 mHz.

REFERENCE DESIGNATORS

NO PREFIX	A9 ASSY
C40, 43, 44, 45 R6, R7 J17	C1-10 CR1, 2 Q1-10 R1-36 U1-4 VR1-3



14

8410B-A9

ALSO: 8410B-C40, C43, C44, C45, R6, AND R7

Figure 8-64. 8410B-A9 Schematic Diagram

8410B A/D CONVERTER A18 CIRCUIT DESCRIPTION

GENERAL DESCRIPTION

When enabled by the convert pulse from the A9 Automatic Control Assembly, the A18 A/D Converter takes the analog FREQ REF INPUT and converts it to a binary output for use in the A19 Frequency Range Assembly. The output is determined by the setting of the A1S1 FREQ RANGE (GHz) switch.

LOG A/D CONVERTER

The Log A/D Converter is composed of a chain of comparators (U7, U8, U11, U12) whose outputs go high (+12V) in succession as the FREQ REF INPUT amp (J16) increases. For example, with a 2.5V FREQ REF INPUT, the outputs of U11 and U12 are high (+12V) and the outputs of U7 and U8 are low (0V).

LATCHES

A high (+12V) Convert signal turns on Q1, which effectively grounds TP7 to open the latches (U5, U6, U9, U10). With the latches open, their outputs correspond with their inputs. When the Convert signal from A9 Automatic Control Assembly becomes low (0V), Q1 shuts off and TP7 switches to a high DC level (+12V). This closes the latches and any change of input has no effect on their output.

ENCODER

The encoder U3 and U4 converts logic from the latches to binary coded decimal logic. The output of U4 is a binary count (0 to 7) of the eight lowest frequency ranges selected, and the output of U3 is a binary count (8 to 13) of the six highest frequency ranges selected. The Encoder is disabled by a low (0V) DC level at pin 5. This signal is present when A1S1 FREQ RANGE (GHz) is in a selected manual frequency range.

MULTIPLEXER

In the AUTO mode of operation, the Multiplexer (U1 and U2) converts the octal output of the encoders to BCD, inverts the logic, and routes it to the A19 Frequency Range Assembly. The inputs from A1S1 FREQ RANGE (GHz) are grounded and have no effect. When the frequency range is manually selected, the inputs to the multiplexer from the encoder are 0 Volts, and the inputs from A1S1 FREQ RANGE (GHz) control the multiplex output. In a manually selected frequency range, a disable signal (Hi) is sent to the encoder and the A9 Automatic Control Assembly.

FREQUENCY RANGE SWITCH

The FREQ RANGE GHz switch on the 8410B front panel connects to the A/D Converter, A18. The switch position puts a logic level at the inputs of Multiplexer U1 and U2, selecting the search window size and loop gain compensation (in A19) for the selected Frequency Range.

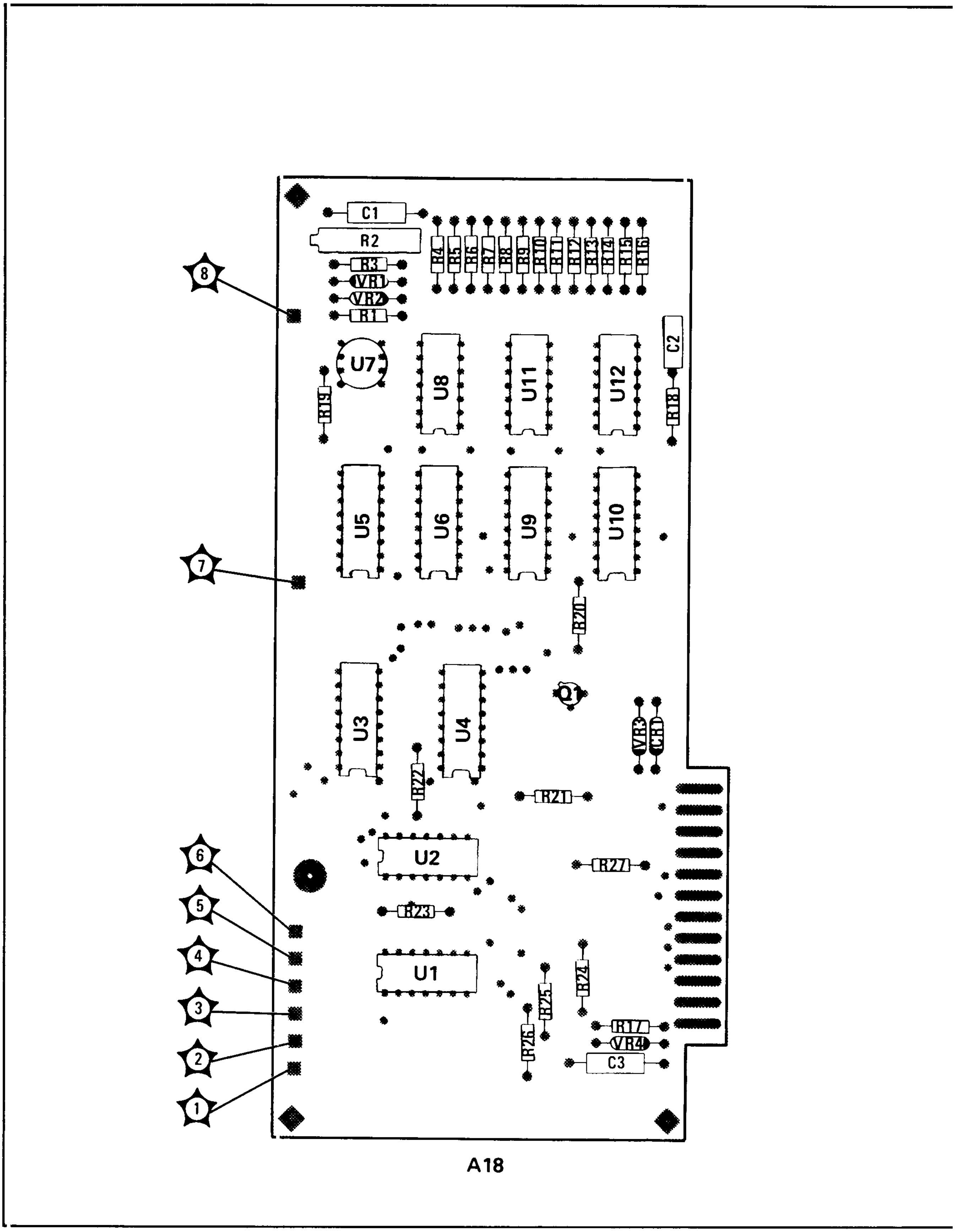
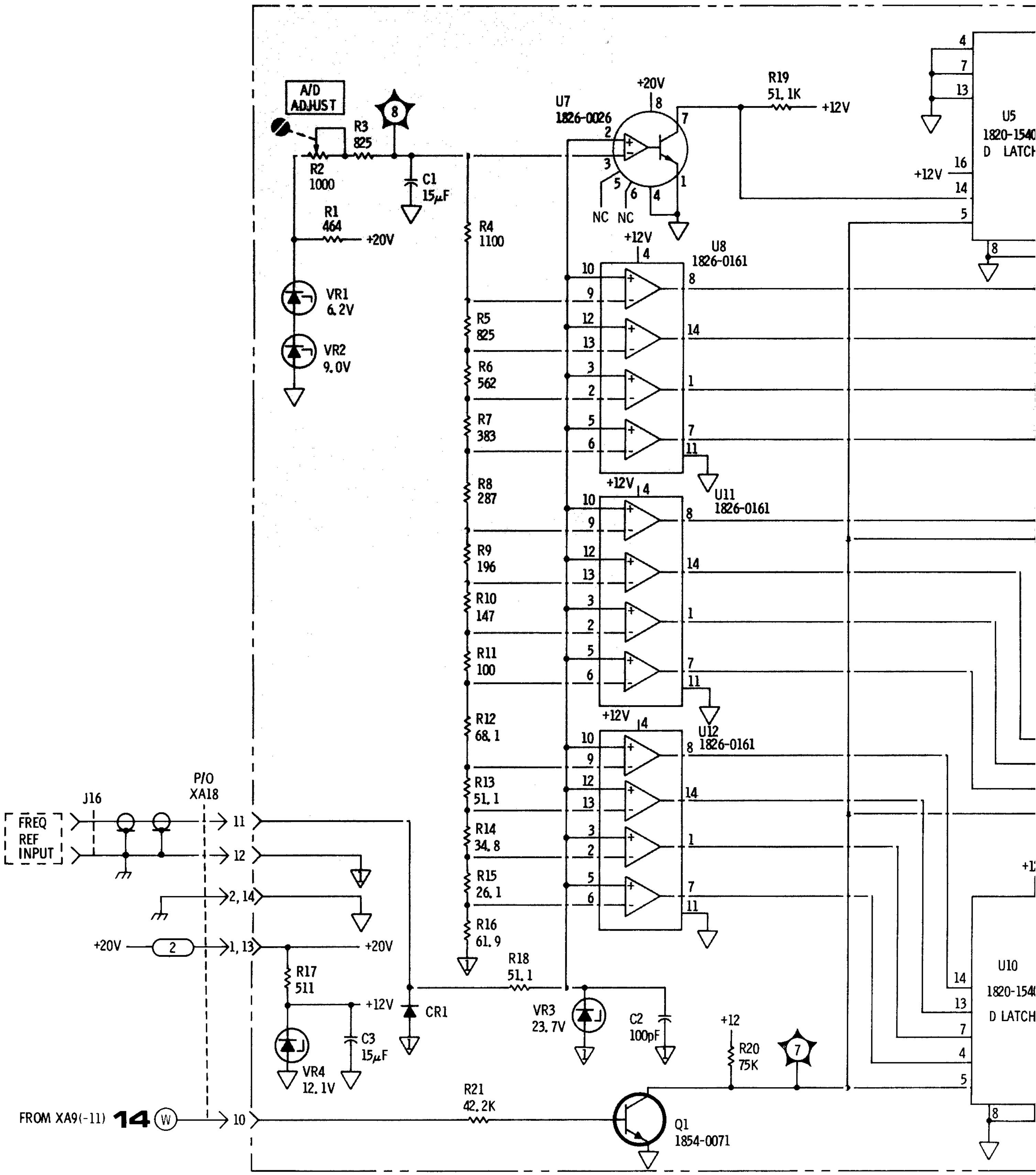
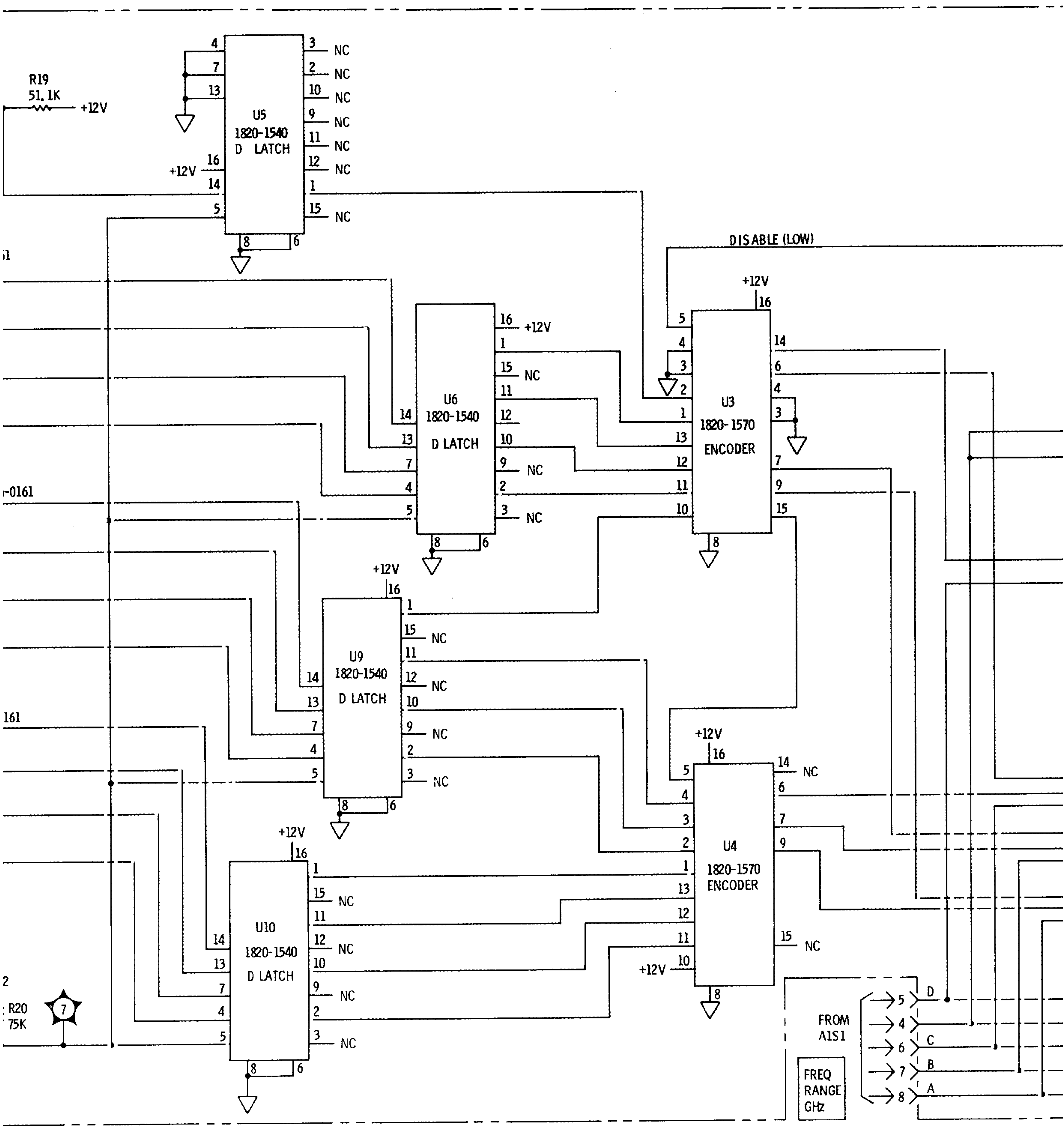


Figure 8-65. 8410B-A18 Parts Location

A18 A/D CONVERTER ASSEMBLY (08410-60107)



SERIAL PREFIX: 1902A DATE: MARCH 1979


R19
51.1K
+12V
U5
1820-1540
D LATCH
NC
U6
1820-1540
D LATCH
U3
1820-1570
ENCODER
DISABLE (LOW)
-0161
U9
1820-1540
D LATCH
161
U4
1820-1570
ENCODER
U10
1820-1540
D LATCH
R20
75K
FROM
A1S1
FREQ
RANGE
GHz
D
C
B
A

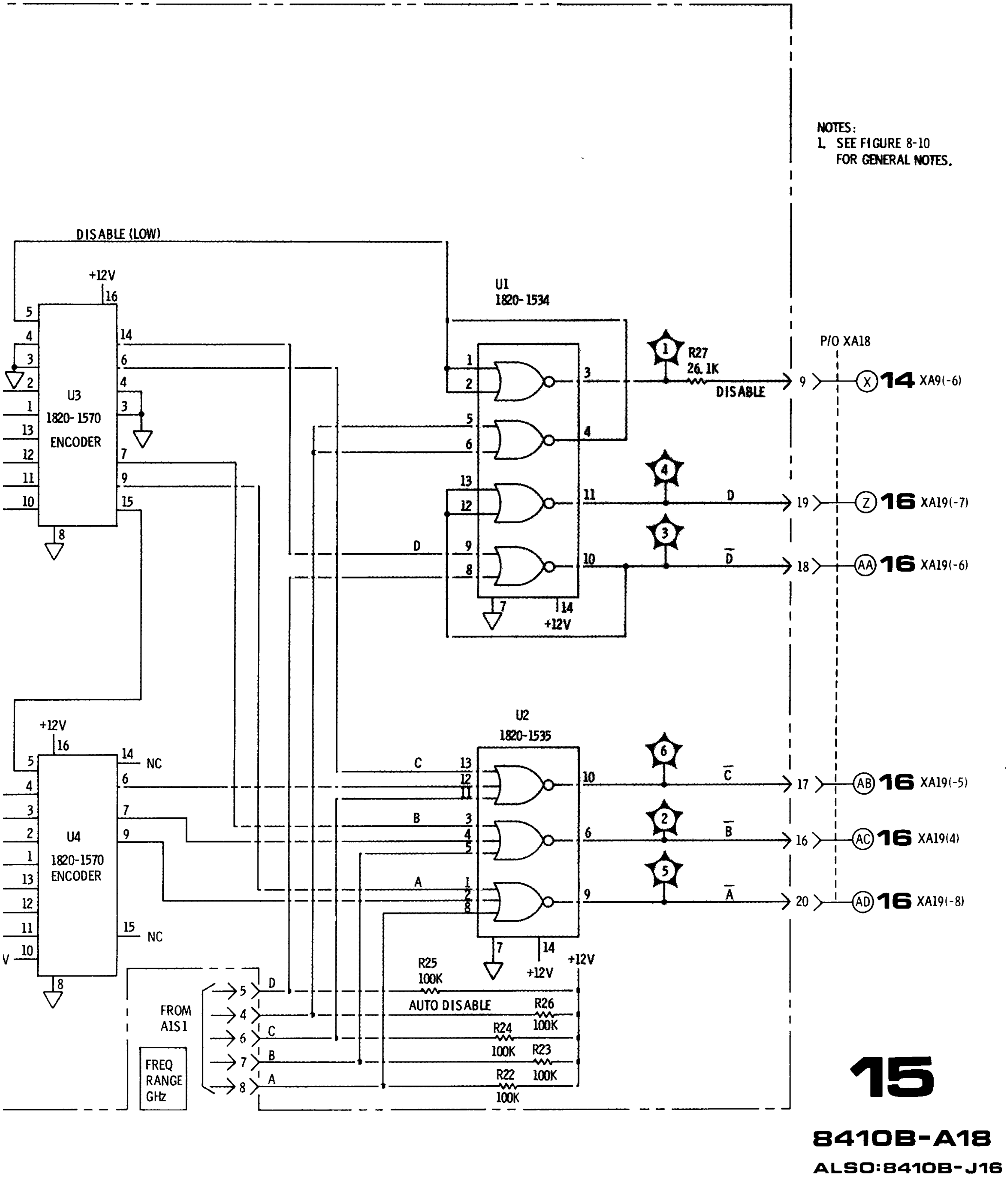


Figure 8-66. 8410B-A18 Schematic Diagram

8410B FREQUENCY RANGE ASSEMBLY A19, CIRCUIT DESCRIPTION

GENERAL DESCRIPTION

The A19 Frequency Range Assembly uses the inverted binary input from the A18 A/D Converter to vary the VTO search signal amplitude and the phase-lock loop gain. This compensates for the increased frequency response of the higher VTO harmonics. A Search Rate Reduction signal is sent to the A9 Automatic Control Assembly for three frequency ranges.

LEVEL SHIFTING

Q1 through Q5 invert the binary logic from the A18 A/D Converter to a standard form ($\overline{A}$ becomes A). The +12V/0V (HI/LO) logic is also shifted to a 0V/−13V (Hi/Lo) logic. For example, a high (+12V) on the gate turns off the FET, and the drain goes low (−13V); a low (0V) on the gate turns on the FET and the drain goes high (0V).

DECODER

U1 is disabled by $\overline{D}$ for the first eight octave bands, and U2 is disabled by D for the next six octave bands. The output of the decoder is used to switch in different resistor values to vary the search signal amplitude and phase-lock loop gain as the harmonic number of the 8411A VTO is increased.

SEARCH WINDOW SIZE

The search signal amplitude is reduced as the frequency of the octave band selected is increased. This is done by switching in progressively smaller resistors in parallel to ground. A high (0V) signal on the gate of a FET(Q6-Q19) indicates the resistor selected (the metal case is tied to the gate).

LOOP GAIN COMPENSATION

Progressively larger resistors are switched in series with the phase error signal to reduce phase-lock loop gain as the 8411A VTO harmonic number is increased. Q31 is switched off on the three highest octave bands for better isolation. Switching of the Loop Gain Compensation circuit is the same as in the Search Window Size circuit.

SEARCH RATE REDUCTION

A high (0V) Search Rate Reduction signal (TP1) is sent to the A9 Automatic Control Asembly on the two lowest and the highest octave bands.

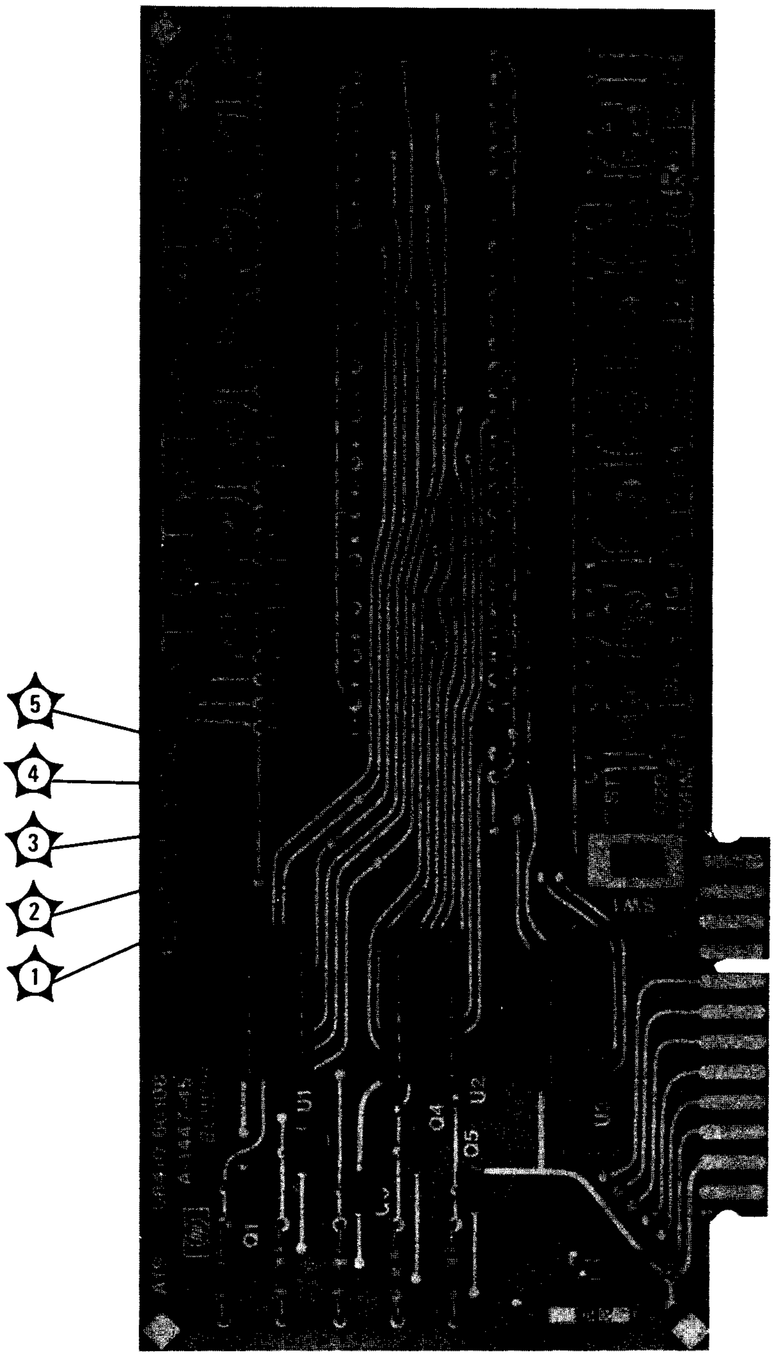
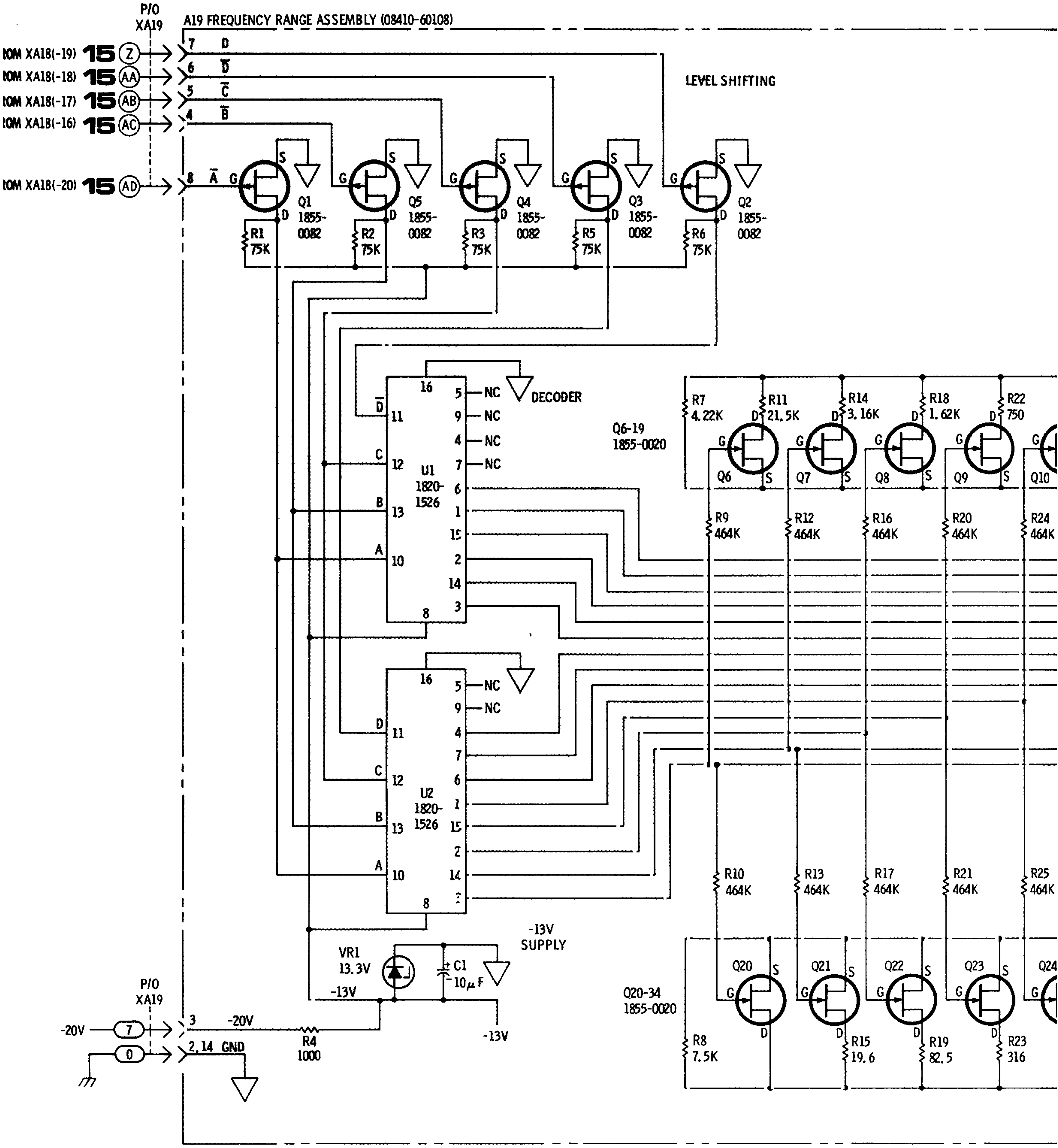
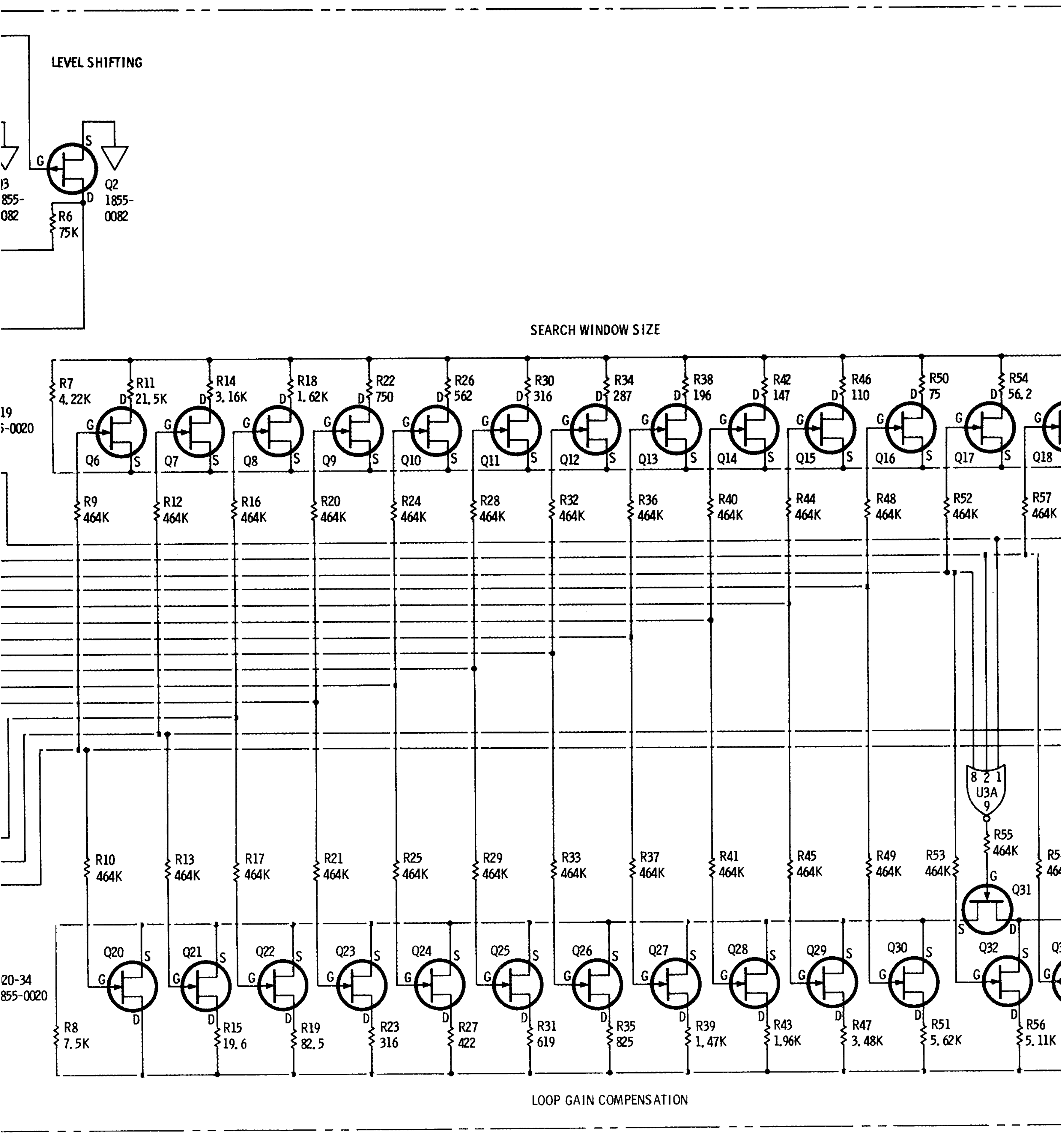


Figure 8-67. 8410B-A19 Parts Location



SERIAL PREFIX: 1902A DATE: MARCH 1979



LEVEL SHIFTING
Q2
1855-
0082
R6
75K
SEARCH WINDOW SIZE
R7
4.22K
R11
21.5K
R14
3.16K
R18
1.62K
R22
750
R26
562
R30
316
R34
287
R38
196
R42
147
R46
110
R50
75
R54
56.2
Q6
Q7
Q8
Q9
Q10
Q11
Q12
Q13
Q14
Q15
Q16
Q17
Q18
R9
R12
R16
R20
R24
R28
R32
R36
R40
R44
R48
R52
R57
464K
U3A
R55
464K
Q31
R10
R13
R17
R21
R25
R29
R33
R37
R41
R45
R49
R53
464K
Q20
Q21
Q22
Q23
Q24
Q25
Q26
Q27
Q28
Q29
Q30
Q32
R8
7.5K
R15
19.6
R19
82.5
R23
316
R27
422
R31
619
R35
825
R39
1.47K
R43
1.96K
R47
3.48K
R51
5.62K
R56
5.11K
LOOP GAIN COMPENSATION

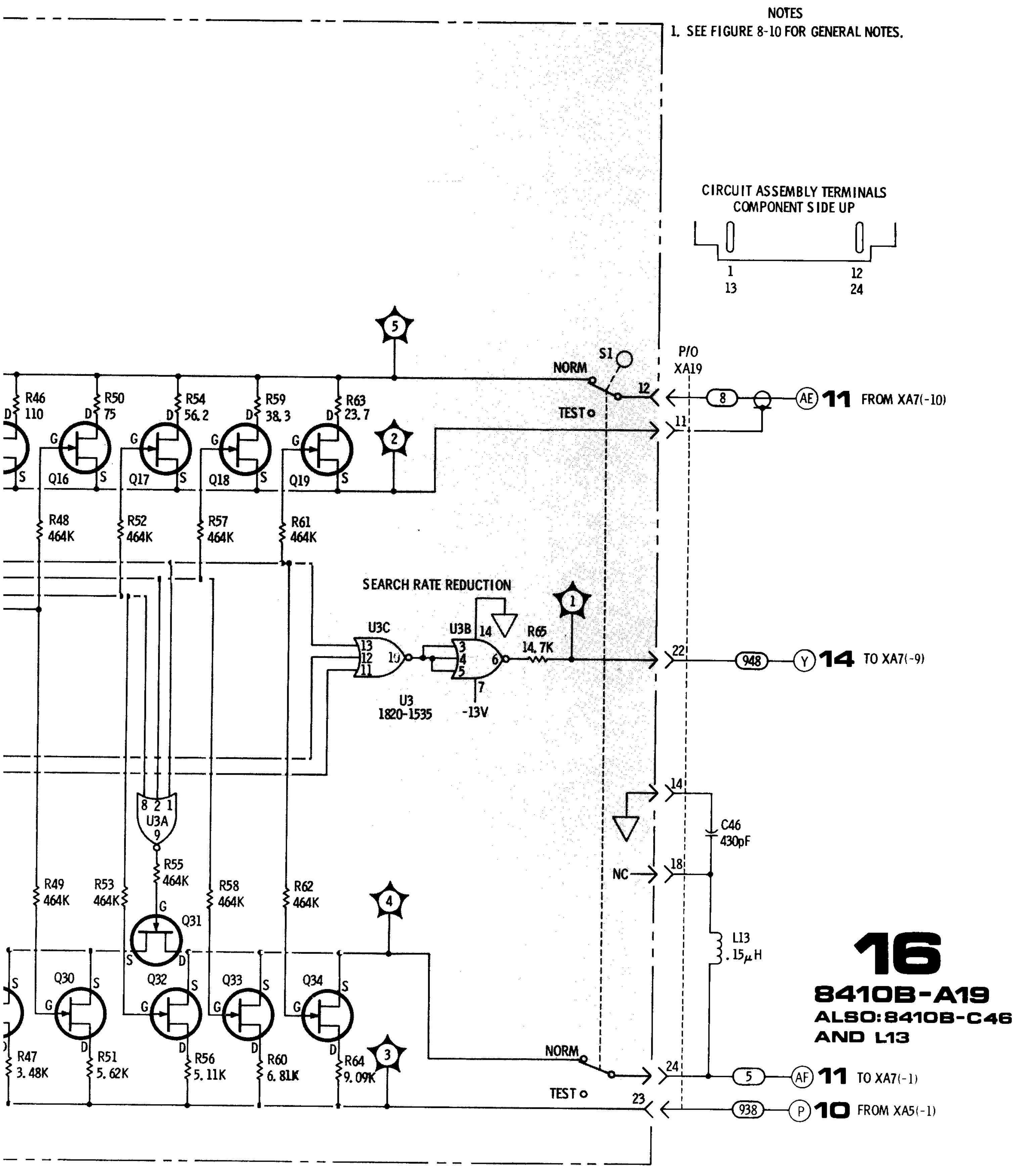
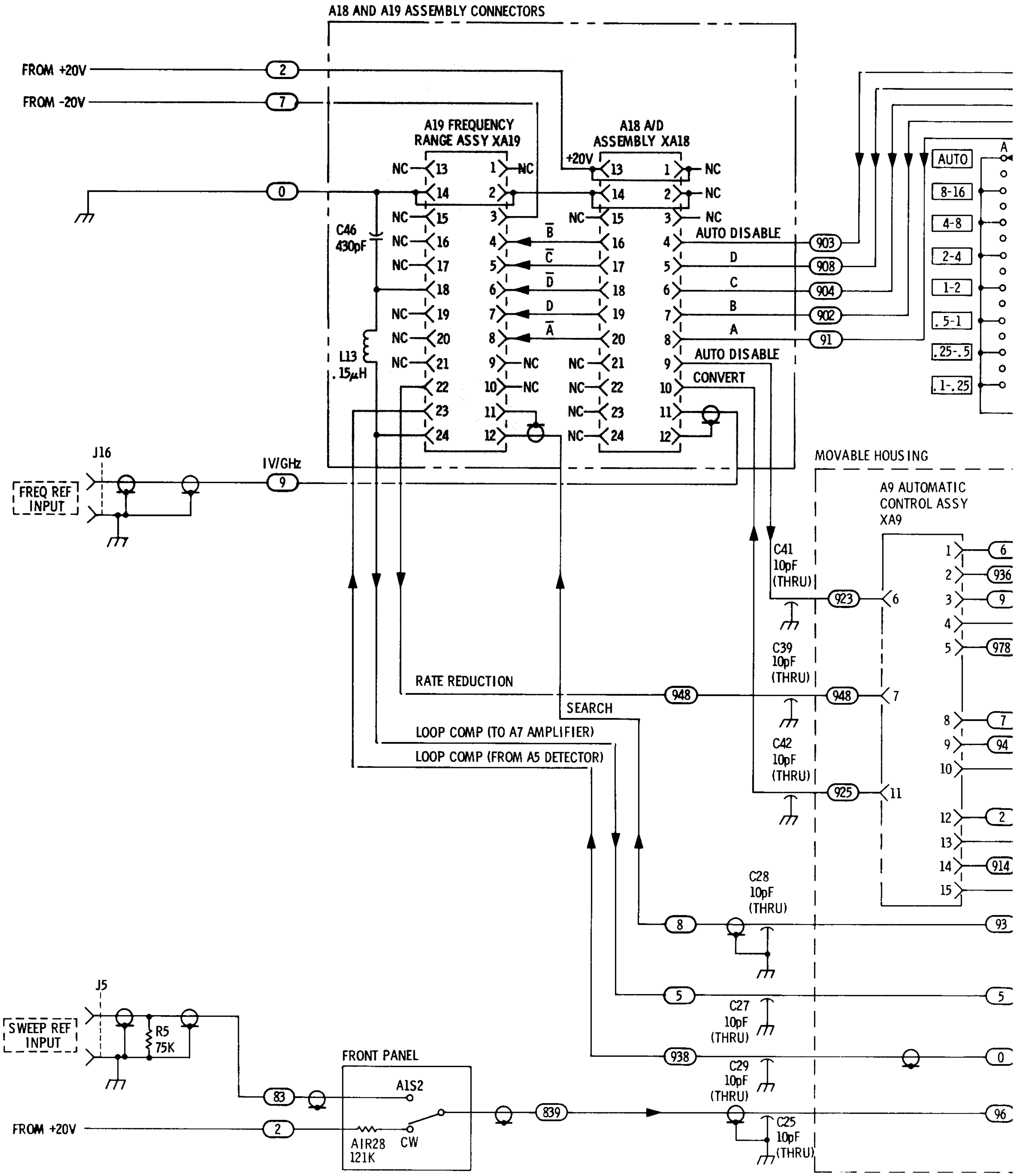
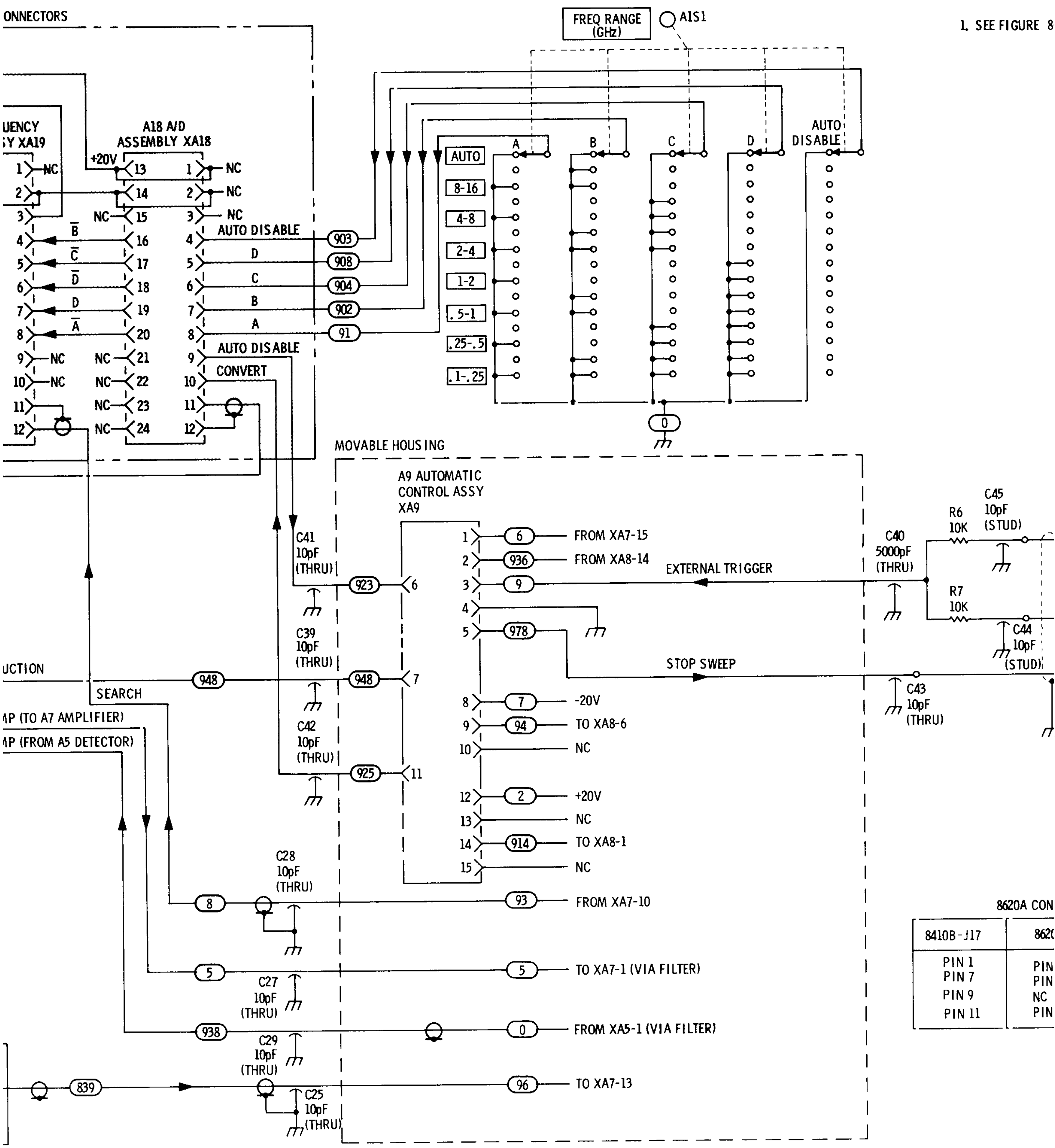


Figure 8-68. 8410B-A19 Schematic Diagram



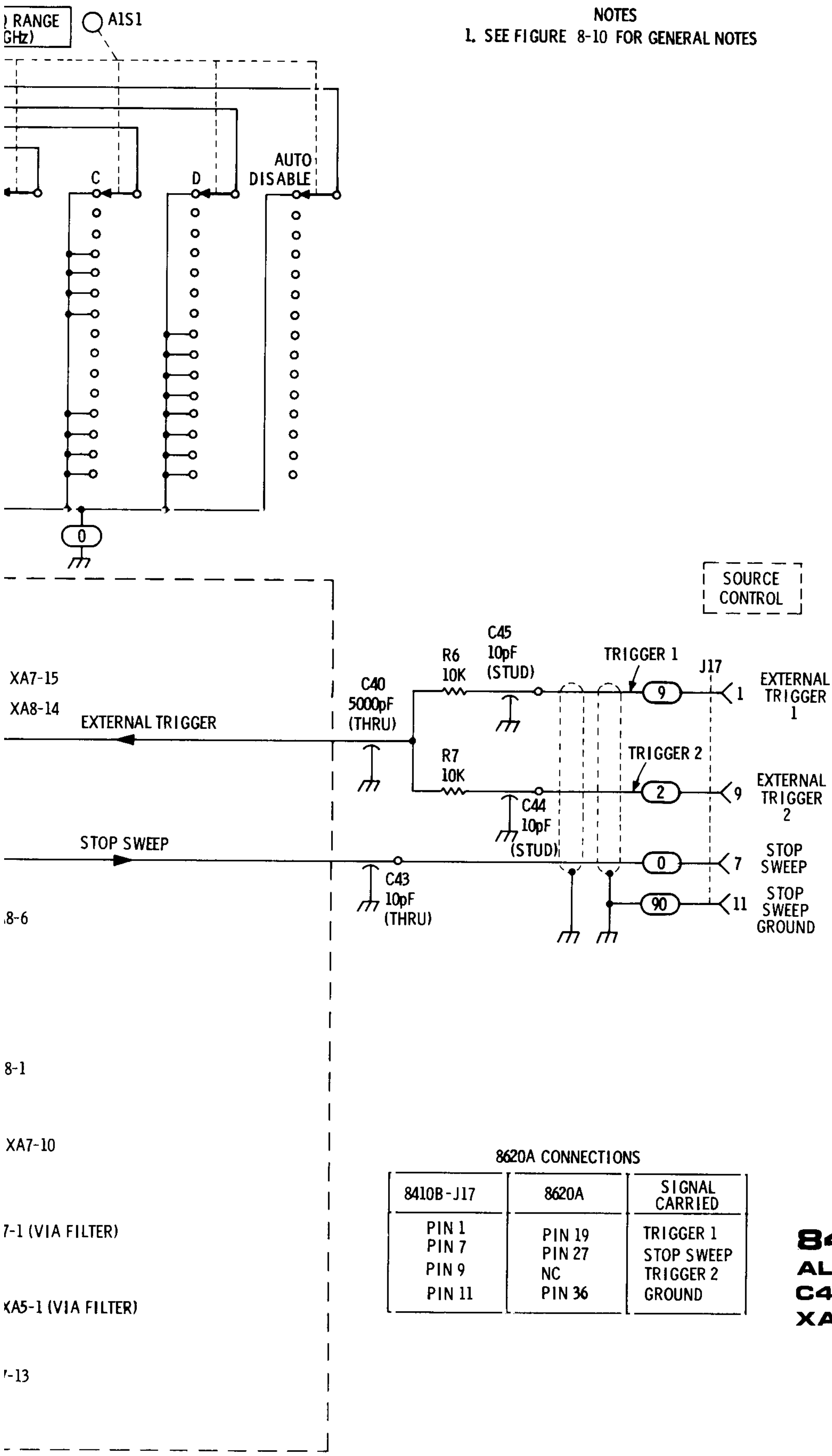
SERIAL PREFIX: 1902A DATE: MARCH 1979



8410B-J17	8620
PIN 1	PIN
PIN 7	PIN
PIN 9	NC
PIN 11	PIN

SERIAL PREFIX: 1902A DATE: MARCH 1979

NOTES
1. SEE FIGURE 8-10 FOR GENERAL NOTES



8620A CONNECTIONS

8410B-J17	8620A	SIGNAL CARRIED
PIN 1	PIN 19	TRIGGER 1
PIN 7	PIN 27	STOP SWEEP
PIN 9	NC	TRIGGER 2
PIN 11	PIN 36	GROUND

17

8410B-A1S1 AND A1S2

ALSO: 8410B-C40, C43, C44, C45, J5, J16, J17, R5, R6, R7, XA9, XA18, AND XA19

Figure 8-69. 8410B Signal Wiring Diagram

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